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THE EFFECT OF FINANCIAL DEVELOPMENT, RENEWABLE AND NON-RENEWABLE ENERGY CONSUMPTION AND INTERNATIONAL TOURISM ON GREENHOUSE GAS EMISSION IN HIGH-INCOME COUNTRIES FROM DIFFERENT CONTINENTS

Finansal Gelişme, Yenilenebilir ve Yenilenemeyen Enerji Tüketimi ve Uluslararası Turizmin Farklı Kıtalardan Yüksek Gelirli Ülkelerde Sera Gazi Emisyonları Üzerindeki Etkisi

Onur GOZBASI[*], Buket ALTINOZ[**]& Oguz OCAL[***]

Keywords:
Emissions, Financial Development, Trade, Tourism, Panel Data

JEL Codes:
J33, P43, Q43, Q53, Z32

Öz

Substantial increases in the use of energy resources pose a serious threat to environmental quality in a globalized world. It is of critical importance for countries with high levels of CO2 emission to achieve their goals of emission reduction. As a matter of fact, greenhouse gases — and CO2 in particular — bring about global warming, climate change and many concomitant adversities. This study tries to explain greenhouse gas emissions with financial development, energy consumption, tourism and trade indicators in high income countries from different continents for the period from 1995 to 2017 by panel quantile approach. Results suggest that financial development, fossil fuel energy consumption, and tourism receipts increase emissions in full sample. Also, tourism is critical in explaining the increase in greenhouse gas emissions of high-income countries in American continent. In Asian continent, financial development positively effects on carbon emissions at 10% and 75% quantile levels but affect negatively at 90% quantile level.

Anahtar kelimeler:
Emisyon, Finansal Gelişme, Ticaret, Turizm, Panel Veri

JEL Kodları:
J33, P43, Q43 Q53,Z32

Abstract

Enerji kaynaklarının kullanımındaki artışlar küreselleşen dünyada çevre kalitesi için ciddi bir tehdit oluşturmaktadır. CO2 emisyonları yüksek olan ülkelerin emisyon azaltma hedeflerine ulaşmaları bu noktada kritik önem taşımaktadır. Nitekim sera gazları ve özellikle CO2 emisyonları küresel ısınmayı, iklim değişikliğini ve birçok olumsuzluğu beraberinde getirmektedir. Bu çalışma farklı kıtalardan yüksek gelirli ülkelerdeki sera gazı emisyonlarını finansal gelişme, enerji tüketimi, turizm ve ticaret göstergeleri ile 1995-2017 dönemi için panel kuantil yaklaşımıyla açıklamaya çalışmaktadır. Sonuçlar finansal gelişme, fosil enerji tüketimi ve turizm gelirlerinin örneklemin tamamında emisyonları artırdığını göstermektedir. Ayrıca, Amerika kıtasındaki yüksek gelirli ülkelerin sera gazı emisyonlarındaki artışı açıklamada turizm kritik bir öneme sahiptir. Asya kıtasında ise finansal gelişme, karbon emisyonlarını %10 ve %75 kuantil seviyelerinde pozitif etkilerken %90 kuantil seviyesinde negatif bir şekilde etkilemektedir.

[*] Nuh Naci Yazgan University, Faculty of Economics and Administrative Sciences, ogozbasi@nny.edu.tr ORCID: 0000-0002-5029-467
[**]Nisantasi University, Vocational School, buket.altinoz@nisantasi.edu.tr ORCID: 0000-0002-4276-4821
[***] Kayseri University, Faculty of Applied Sciences, oguzocal@kayseri.edu.tr, ORCID: 0000-0002-5729-7218

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1. Introduction and Literature

According to the US Energy Information Administration (EIA), global energy consumption is expected to grow by approximately 50% by the year 2050 (EIA 2019, 24). Hence, a more efficient use and generation of energy is highly important for the reduction of CO2 emission. This in turn will make it possible to meet the increasing demand for energy and cause less impact on the environment, since the production and consumption of energy account for more CO2 emissions when compared to other sectors (Environmental Protection Agency [EPA], 2017).

The relevant literature about CO2 emission focusing on the relationship between energy consumption and economic growth has recently started to highlight the role of different variables in such relationship. Indeed, Shahbaz, Solarin, Mahmood and Arouri (2013) remark that additional variables may help explain the complexities surrounding the relationship between economic activity and the environment. In this respect, the researchers first distinguished between renewable and non-renewable energy, and then introduced the concept of financial development and its various indicators into the literature. Finally, they also incorporated the analyses performed by using different data which pertain to the variable of tourism. A deeper insight into the direction and theoretical basis of the interaction among the relevant variables can be found in research on the relationship between economic growth and energy consumption (Ozturk, 2010; Payne, 2010; Yildirim and Aslan, 2012); research on financial development and CO2 (Sadorsky, 2010; Sadorsky 2011; Aslan, Gozbasi, Altinoz and Altuntas 2021); and research on the relationship between tourism and CO2 (Katircioglu, Feridun and Kilinc 2014; Sharif, Afshan and Nisha 2017).

Sustainable and future-oriented growth of any country needs to be addressed within the context of energy and the environment (Azad, Rasul, Khan, Sharma and Bhuiya 2015). Humans can obviously be affected by environmental quality, which, in turn, can have adverse repercussions in their lives. Energy-related greenhouse emissions are known to be responsible for the majority of overall greenhouse emissions (Sadorsky, 2010). However, while there are so many factors causing CO2 emissions in the present-day world, it would not be relevant to analyze the matter only from the perspective of energy consumption. Therefore, the present study aims to explain the causality interaction among greenhouse gas emissions, financial development, energy consumption, international tourism and trade openness.

Developments in the financial system can have an impact upon economic growth and thereby demand for energy (Aslan and Gozbasi, 2016). Financial development constitutes an important component of economic growth in that it affects savings, enhances the effectiveness of international investments and investments in general, creates employment opportunities and promotes technological development (Levine, 2004; Beck, 2006). Additional impacts include the reduction of liquidity risk for companies, the creation of funds for energy-efficient technologies in the long run or the promotion of the implementation of green technologies (Anton and Nucu, 2020). Hence, it will be understood that the direction of the relationship between the two variables may vary in the short and long run. Consequently, studies in the literature dealing with the relationship between economic growth and the environment rather focus on the prediction of the Environmental Kuznets Curve (EKC). This hypothesis holds that, due to the use of more energy and resources, the environmental pollution level will be initially higher during the early stages of economic growth. The Environmental Kuznets Curve (EKC)

implies that, as income levels rise in later stages of industrialization, people will have greater respect for the environment, public authority will function more efficiently, and economic growth will have a positive impact upon the environment in the long term with sustained growth (Dinda, 2004).

Some of the studies discussing the relationship between financial development and energy consumption report the positive role of the former in improving environmental quality, while certain studies found that financial development is detrimental to environmental quality. For instance, financial development reduces CO2 emissions in the China case according to Jalil and Feridun (2011) and in the Malaysia case according to Shahbaz et al. (2013). Zaidi, Zafar, Shahbaz and Hou (2019) claim that financial development brings down CO2 emission levels both in the short and long run. On the other hand, while Ozturk and Acaravcı (2013) did not detect any significant long-term relationship between financial development and CO2 emissions in Turkey; Sadorsky (2010), in his pioneering study, states that an increase in financial development brings about a higher demand for energy in developing economies. Financial development leads to more industrial and consumption activities, which are in turn the cause of further pollution. Likewise, Zakaria and Bibi (2019) state that financial development harms the environment in the case of South Asian countries. According to the authors this happens mainly because South Asian countries fail to use financial development in order to improve technology. Some recent studies argue that the direction of the financial development-energy consumption relationship may differ depending on the development level of countries. While underlining the presence of the link between financial development and energy consumption, Aslan et al. (2021) also demonstrate that the direction of such link varies for developing and developed countries as seen in the cases of G7 and top 10 emerging markets. Similarly, drawing upon the data pertaining to 28 EU countries during the 1990-2015 period, Anton and Nucu (2020) conclude that the three different dimensions of financial development (banking sector, bond market and capital market) have a positive impact upon the share of renewable energy. Nevertheless, the results of the same study underline that the development of capital markets did not have any effect on renewable energy consumption in the new EU member countries.

With its contributions including the inflow of foreign currency and improvement of infrastructure, the flourishing of tourism occupies a crucial place in sustainable economic development (Ali, Khan and Khan 2018). The tourism sector is also associated with energy consumption and the environment. Thus, each and every stage of tourism activities involves energy consumption directly through fossil fuels and indirectly electric energy. The source of energy used in the sector in turn impacts upon environmental pollution either positively or negatively (Dogan and Aslan, 2017). On the other hand, focusing on the transport aspect of tourism, Dubois, Peeters, Ceron and Gössling (2011) underline the fact that global passenger transport is largely associated with tourism and draw attention to transport-related emissions. Katircioglu (2014) demonstrates that the development of tourism in Turkey resulted in significant increases both in energy consumption and climate change. Sharif et al. (2017) discuss policies that could potentially contribute to sustainable economic growth, curtail the detrimental impacts of touristic activities upon the environment (and diminish the effect of a flourishing tourism sector upon gas emissions).

Trade openness also exerts a positive impact upon economic growth. Furthermore, the relationship between trade and financial development is also important in terms of its contribution to economic growth (Pradhan, Arvin, Hall and Norman 2017). Indeed, with regard

to a more efficient use of the sources and utilization of the advantages of economies of scale, international trade will bring significant benefits to economic growth. In such case, it is extremely important to highlight the use of more environment-friendly technologies (Khan, Yaseen and Ali 2017). Feridun, Ayadi and Balouga (2006) investigates into the impact of trade openness on pollution and depletion of resources in Nigeria. The result of the study reveal that the intensity of trade is positively correlated with environmental degradation, thus, implying detrimental consequences for the environment. In contrast, Antweiler, Brian and Taylor (2001) maintain that more free trade appears to be better for the environment. Shahbaz, Nasreen, Ahmed and Hammoudeh (2017) examines the relationship between openness and CO2 for a total of 105 countries classified under three groups, i.e. high-, medium- and low-income countries. The authors are of the opinion that trade openness inhibits environmental quality. Yet, such impact varies across different groups of countries. Similar results were also obtained by Wang and Wang (2021), who analyzed the impact of trade openness on carbon intensity in 104 countries/regions. The study revealed that trade openness has heterogenous effects on carbon intensity for countries belonging to different income groups.

2. Data and Methodology

His paper analyzes the nexus among greenhouse gas emissions, financial development, energy consumption, international tourism, and trade openness1. First, a basic production function accounting framework yields:

$$GHG=f(FD, FOSSIL, REN, TOU, TRA) \quad (1)$$

where GHG denotes GHG emission per capita, FD shows financial development index (0-100), FOSSIL implies fossil fuel consumption, REN is renewable energy consumption, TOU represents international tourism receipts, and TRA is trade share in GDP used as control variable. Initially, Khan et al. (2019) is considered, but unlike it, the models are divided into two according to the type of energy consumption. These models can be written as a simple panel data model:

$$GHG_{it} = \alpha_{i0} + \beta_{1i}FD_{it} + \beta_{2i}FOSSIL_{it} + \beta_{3i}TOU_{it} + \beta_{4i}TRA_{it} + \varepsilon_{it} \quad (2)$$

$$GHG_{it} = \alpha_{i0} + \beta_{1i}FD_{it} + \beta_{2i}REN_{it} + \beta_{3i}TOU_{it} + \beta_{4i}TRA_{it} + \varepsilon_{it} \quad (3)$$

where α_{i0} shows the constant term, the symbols β_1, β_2, β_3, and β_4 denotes the coefficients of independent variables, and ε represents the error term.

In climate change models, energy consumption is generally used as the main explanatory variable (as seen in Nasir and Rehman, 2011; Saboori, Sulaiman and Mohd 2012; Shahbaz, Lean and Shabbir 2012; Alam, Murad, Noman and Ozturk 2016 etc.). The common result of most of them is that energy consumption increases carbon emissions. However, the impact of renewable and non-renewable energy consumption on pollution over time rather than total energy consumption has been examined in many studies. For example, Chen, Zhao, Lai, Wang and Xia (2019) explored the effects of renewable and non-renewable energy consumption on

[1] Ethics committee approval/or legal/special plan planning was not required in this study and publication ethics were complied with

CO_2 emissions in China. Their results suggested that non-renewable energy consumption have a positive impact on carbon emissions, while renewable energy consumption has a negative impact. Also, Lee (2019) investigated the linkage between renewable energy consumption on carbon emissions and economic growth in the European Union. Analysis results illustrated that renewable energy consumption and exports have a negative impact on CO_2 emission. The relationship among financial development and climate change is also of increasing importance (Shahbaz et al., 2013; Haseeb, Danish, Baloch and Abbas 2018; Zaidi et al., 2019; etc.). For instance, this linkage is handled by Zaidi et al. (2019) for APEC countries, and they found that financial development reduces carbon emissions. International tourism, another explanatory variable, is also popularly studied in terms of its impact on climate change. One of these studies is Sharif et al. (2017). They investigated the relationship for Pakistan and results illustrated that the existence of positive relationship between tourism and pollution. Eyuboglu and Uzar (2018) studied for Turkey. Their results suggested the positive impact of tourism on CO_2 emission.

To explore the linkage between carbon emissions, financial development, renewable and fossil energy consumption and tourism panel quantile approach proposed by Koenker and Bassette (1978) and Koenker (2004) is used. This method considers heterogeneity. Also, panel quantile regression robust to outliers and skewness. It groups the sample according to various quantile levels and coefficient estimation make for these quantiles.

The main equation of this method is as follows:

$$y_{it} = \alpha_i + \beta(q)x'_{it} + u_{it} \quad (4)$$

where i is the number of countries and t is the time dimension. The dependent variable y is greenhouse gas emission, while x is the vector of each independent variables. q is the quantile ($0 < q < 1$) of the conditional distribution.

The estimation of Equation (2) is obtained by solving the following minimization problem:

$$min_{\alpha\beta} \sum_{k=1}^{\tau} \sum_{j=1}^{n} \sum_{i=1}^{m} w_k \rho_{qk}(y_{ij} - \alpha_i - \beta(q_k)x'_{ij}) \quad (5)$$

This equation, called penalized quantile regression, takes the following form:

$$min_{\alpha\beta} \sum_{k=1}^{\tau} \sum_{j=1}^{n} \sum_{i=1}^{m} w_k \rho_{qk}(y_{ij} - \alpha_i - \beta(q_k)x'_{ij}) + \lambda P(\alpha) \quad (6)$$

where $p(\alpha) = \sum_{i=1}^{n} |\alpha_i|$ is the penalty considered.

The analysis covers the 1995 to 2017 data period for 34 high-income countries from America (5 countries2), Europe (23 countries[3]) and Asia (6 countries[4]). Countries and the time

[2] Argentina, Chile, Panama, United States, Uruguay.
[3] Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom.
[4] Hong Kong, Israel, Japan, Korea, Rep., Saudi Arabia, Singapore.

period are selected on data availability. Data on financial development index (FD) represents a value between 0 and 100, and obtained from IMF. Renewable energy consumption (REN) and fossil fuel energy consumption (FOSSIL) represent share in total energy consumption, and obtained from WDI. Another explanatory variable, international tourism (TOU) is tourism share in export, and trade openness (TRA) is trade share in GDP, and provided from WDI. Finally, greenhouse gas emission (GHG) used as dependent variable denotes metric ton of CO_2, equivalent per capita obtained from WDI. All variables are expressed in logarithms. Table 1 provides certain descriptive statistics.

Table 1. Descriptive Statistics

Variables	Mean	SD	Min	Max
Full sample				
FD	1.740	0.180	0.948	2
FOSSIL	1.685	0.575	0	2
REN	0.834	0.745	-2.323	1.779
TOU	0.833	0.315	0.042	1.674
TRA	1.940	0.290	1.222	2.646
GHG	1.014	0.168	0.468	1.460
America				
FD	1.568	0.238	1.948	1.948
FOSSIL	1.666	0.600	0	1.957
REN	1.272	0.325	0.654	1.777
TOU	0.952	0.222	0.441	1.393
TRA	1.695	0.268	1.296	2.221
GHG	0.933	0.260	0.468	1.393
Europe				
FD	1.762	0.154	1.289	2
FOSSIL	1.672	0.559	0	2
REN	1.002	0.477	-1.058	1.779
TOU	0.882	0.309	0.269	1.674
TRA	1.976	0.221	1.569	2.627
GHG	1.024	0.149	0.722	1.460
Asia				
FD	1.800	0.127	1.337	1.945
FOSSIL	1.751	0.614	0	1.999
REN	-0.177	0.950	-2.323	0.955
TOU	0.547	0.229	0.042	1.104
TRA	2.008	0.413	1.222	2.646
GHG	1.045	0.109	0.759	1.270

3. Empirical Results

First, a second-generation panel unit root test developed by Pesaran (2007) applied to test the stationarity. This method eliminates cross-sectional dependence. The results of this test are reported in Table 2. These results suggest that FD, FOSSIL and REN are stationary at level in full sample. FD, and FOSSIL are stationary at level in America. FD, FOSSIL, and GHG are stationary at level in Europe. All variables integrated at first difference in Asia.

Table 2. Panel Unit Root Test (CIPS)

	Intercept		Intercept and Trend		None	
Variables	**Levels**	**1st Difference**	**Levels**	**1st Differences**	**Levels**	**1st Differences**
Full sample						
FD	-2.375*	-2.922*	-2.926*	-3.918*	-1.684**	-2.547*
FOSSIL	-5.687*	-5.442*	-6.063*	-5.918*	-5.670*	-4.226*
REN	-2.118**	-3.638*	-3.131*	-5.102*	-1.038	-2.327*
TOU	-1.418	-3.127*	-2.414	-4.376*	-1.222	-2.878*
TRA	-1.223	-2.176**	-1.668	-4.891*	-1.033	-4.081*
GHG	-1.738	-3.040*	-2.989*	-5.017*	-1.242*	-2.991*
America						
FD	-2.346**	-3.216***	-2.731***	-5.037*	-0.880	-3.603*
FOSSIL	-4.890*	-5.072*	-6.420*	-6.420*	-6.120*	-5.620*
REN	-0.757	-1.007	-2.823***	-3.216*	-0.749	-1.015
TOU	-1.328	-2.531**	-2.252	-3.877*	-1.360	-3.007*
TRA	-1.384	-3.739*	-1.759	-3.621*	-1.525	-3.538*
GHG	-2.429**	-4.878*	-2.440	-6.140*	-1.199*	-5.037*
Europe						
FD	-2.203**	-3.446*	-2.781**	-4.613*	-1.759*	-3.939*
FOSSIL	-2.244**	-2.061***	-2.296*	-2.111	-2.303*	-3.150*
REN	-1.633	-2.905*	-3.092*	-4.954*	-0.879	-1.821*
TOU	-1.783	-3.145*	-2.469	-4.010*	-1.349	-2.630*
TRA	-1.625	-2.432*	-1.771	-4.652*	-1.723**	-4.254*
GHG	-2.143***	-3.160*	-3.103*	-4.570*	-1.494***	-2.605*
Asia						
FD	-2.463**	-2.737*	-2.346	-4.583*	-1.211	-3.818*
FOSSIL	--2.083	-4.585*	-6.420*	-6.420*	-6.120*	-5.411*
REN	-2.535**	-4.436*	-2.665	-4.598*	-0.895	-2.834*
TOU	-1.431	-3.045*	-1.645	-3.812*	-1.167	-3.012*
TRA	-1.983	-4.655*	-2.315	-5.596*	-0.782	-4.625*
GHG	-1.727	-2.674*	-2.590	-4.002*	-1.340	-2.704*

***, ** and * denotes 10%, 5% and 1% statistically significance levels, respectively.

Table 3 reports the estimates for Equation 1 and 2 and for the full sample per quantile (i.e., low-pollution-10-25%; medium-pollution-50%; and high-pollution-75-90%). According to model 1 results, financial development, fossil fuel energy consumption and tourism receipts increase pollution. These results are in line with Zakaria and Bibi (2019) for financial development, Chen et al. (2019) for fossil fuel energy consumption, and Sharif et al. (2017) and Katircioglu (2014) for tourism. The positive impact of financial development continues up to the high quantile level. On the other hand, although a negative effect is observed at the 75% quantile level, the positive effect reappears at the 90% quantile level. The impact of financial development also applies to model 2. Fossil energy consumption is positive up to medium quantile, but negative from this level. This result indicates that as the level of pollution increases throughout the panel, other factors causing the pollution gain importance. On the other hand, renewable energy consumption reduces carbon emissions at all levels. While the effect of tourism is negative at all levels in model 2, it is negative at 25%, 50% and 75% quantile levels

in model 1. Finally, the impact of trade openness on greenhouse gas emissions is negative up to high quantile levels in both models, while it is positive at high quantile levels.

Table 3. Panel Quantile Estimates (Full Sample)

Model 1			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	.496*	.047*	.308*	-.149*	.343*
	[.043]	[.005]	[.075]	[.015]	[.034]
FOSSIL	.025***	.019*	-.032	-.037	-.009
	[.012]	[.001]	[.035]	[.032]	[.031]
TOU	.021***	-.047*	-.129*	-.154*	.118*
	[.012]	[.014]	[.017]	[.012]	[.030]
TRA	-.009	-.101*	-.118*	-.073*	.160*
	[.060]	[.020]	[.017]	[.026]	[.025]
Model 2			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	.295*	.122*	.071*	-.006	.380*
	[.032]	[.001]	[.025]	[.028]	[.027]
REN	-.071*	-.095*	-.089*	-.007	-.044*
	[.013]	[.000]	[.009]	[.005]	[.016]
TOU	-.003	-.049*	-.031	-.064*	-.007
	[.019]	[.000]	[.028]	[.012]	[.048]
TRA	-.152*	-.154*	-.050*	.062***	.020
	[.035]	[.001]	[.016]	[.033]	[.035]

Table 4 presents the estimates for Equation 1 and 2 and for the America sample per quantile. Pollution-increasing effects of financial development in high-income countries in the America have been identified (as seen in Zakaria and Bibi, 2019). The effect of trade openness is negative at low, medium and high quantile levels in both models (similar to Lee, 2019 and Antweiler, 2017). The results are interesting in terms of tourism receipts. Because in the first model all tourism coefficients are positive and statistically significant up to 90% quantile level (similar to Sharif et al., 2017 and Katircioglu, 2014), while in the other model they are negative but statistically insignificant (except for the medium quantile level). The only positive coefficient found in model 2 is found to be significant. This result shows that tourism is critical in explaining the increase in greenhouse gas emissions of high-income countries in America continent. Fossil fuel consumption in these countries increases pollution at 50% and 75% quantile levels, while the coefficient of renewable energy consumption is negative at 10%, and positive at 25% and 50% quantile levels. Accordingly, it can be said that renewable energy sources are not given sufficient importance and that they cannot be used efficiently in America.

Table 4. Panel Quantile Estimates (America)

Model 1			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	.947*	.876*	.440*	.385*	-9.02
	[.054]	[.115]	[.005]	[.001]	[1.36]
FOSSIL	-.044	.034	.020*	.035*	-1.25
	[.053]	[.047]	[.001]	[.000]	[2.24]
TOU	.042	.215*	.307*	.201*	4.25
	[.033]	[.072]	[.000]	[.005]	[7.63]
TRA	-.265*	-.684*	-.716*	-.698*	2.06
	[.071]	[.147]	[.002]	[.005]	[3.71]
Model 2			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	1.010*	1.145*	.554*	.475	1.01
	[.007]	[.129]	[.019]	[.752]	[4.02]
REN	-.242*	.400**	.192*	-.345	1.66
	[.079]	[.191]	[.016]	[1.06]	[6.64]
TOU	-.033	-.064	.279*	-.270	-2.55
	[.040]	[.148]	[.013]	[.577]	[1.02]
TRA	-.261*	-.492*	-.753*	-.135	-8.56
	[.076]	[.071]	[.018]	[.583]	[3.42]

Table 5 denotes the estimates for Equation 1 and 2 and for the Europe sample per quantile. Initially, model 1 results suggest that financial development positively effect on carbon emissions at 10% and 75% quantile levels (similar to Zakaria and Bibi, 2019) but affect negatively at 90% quantile level (as seen in Jalil and Feridun, 2011; Shahbaz et al., 2013 and Zaidi et al., 2019).

Table 5. Panel Quantile Estimates (Europe)

Model 1			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	.311*	.130	.101	.145*	-.138*
	[.008]	[.127]	[.067]	[.021]	[.009]
FOSSIL	.066*	.000	.100*	-.018	.071*
	[.001]	[.024]	[.021]	[.020]	[.007]
TOU	.013	-.083*	-.090*	-.059*	-.157*
	[.009]	[.017]	[.017]	[.009]	[.008]
TRA	.088*	.083*	.340*	.397*	.337*
	[.007]	[.057]	[.047]	[.017]	[.008]
Model 2			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	.000	.073*	.047***	.000	.024
	[.003]	[.009]	[.027]	[.053]	[.078]
REN	-.067*	-.065*	-.112*	-.025	-.035***
	[.002]	[.001]	[.027]	[.019]	[.019]
TOU	-.128*	-.110*	-.119*	-.071*	-.101*
	[.008]	[.004]	[.019]	[.020]	[.036]
TRA	-.212*	-.064*	.131**	.307*	.373*
	[.004]	[.008]	[.055]	[.022]	[.023]

Fossil fuel energy consumption increase pollution at low, medium and high quantile levels, while this effect because insignificant at levels 25% and 75%. However, the effect of

renewable energy consumption is negative at all quantile levels. Thus, even if there is no absolute negative impact of fossil fuel energy consumption at all pollution levels, renewable energy consumption is indispensable in combating climate change in these countries. Tourism receipts have a pollution-reducing effect on both models. This finding differs from the common literature. This result reflects that tourism revenues can be used as an important environmental policy tool in sustainable areas. Finally, the environmental cost of foreign trade in these countries is inevitable.

Table 6 provides the estimates for Equation 1 and 2 and for the Asia sample per quantile. The results for Asia continent are controversial compared to other samples. The results of coefficient of financial development are negative in model 1 (as seen in Zaidi et al., 2019; Jalil and Feridun, 2011; Shahbaz et al., 2013), while positive in model 2 (as seen in Zakaria and Bibi, 2019). Both fossil fuel energy consumption and renewable energy consumption reduce pollution at high-quantile levels. However, renewable energy consumption also tackles low and medium levels of climate change. Interestingly, the increase in the share of trade in GDP in these countries has been found to reduce emissions. This finding is in line with Lee (2019) and Antweiler (2017). This implies an increase in the importance these countries attach to sustainability along with foreign trade. Tourism decreases pollution in model 1 but increases it in model 2.

Table 6. Panel Quantile Estimates (Asia)

Model 1			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	-.154*	-.274**	.105	-.582*	-.587*
	[.003]	[.109]	[.088]	[.000]	[.000]
FOSSIL	.002	-.001	.017	-.066*	-.081*
	[.002]	[.015]	[.036]	[.000]	[.000]
TOU	-.089*	.060	-.088***	-.301*	-.342*
	[.017]	[.038]	[.045]	[.000]	[.000]
TRA	-.097*	-.078*	-.010	-.021*	-.029*
	[.003]	[.012]	[.018]	[.000]	[.000]
Model 2			**Quantiles**		
Variables	10%	25%	50%	75%	90%
FD	.112*	.062*	.227*	.416*	3.86
	[.005]	[.016]	[.021]	[.156]	[2.12]
REN	-.095*	-.083*	-.080*	-.055*	-5.32
	[.000]	[.003]	[.005]	[.010]	[2.92]
TOU	.186*	.084*	.037*	.166**	-3.73
	[.003]	[.006]	[.009]	[.084]	[2.05]
TRA	-.287*	-.208*	-.058*	-.095**	-2.21
	[.001]	[.004]	[.011]	[.048]	[1.21]

4. Conclusion

Combating climate change is a critical issue on a global scale today. Therefore, investigation of the causes of climate change has a large place in the literature. In this study, the determinants of greenhouse gas emissions, which are the main indicators of climate change, are discussed. The effects of financial development, renewable and fossil fuel energy consumption, international tourism and trade on greenhouse gas emissions are investigated with the panel

quantile approach. Important findings are reached in this research conducted for high income countries on different continents. According to full sample results, financial development, fossil fuel energy consumption and tourism receipts increase pollution. The positive impact of financial development continues up to the high quantile level. The effect of trade openness is negative at low, medium and high quantile levels in American continent. Also, tourism is critical in explaining the increase in greenhouse gas emissions of high-income countries in America continent. The effect of renewable energy consumption is negative at all quantile levels in Europe and tourism receipts have a pollution-reducing effect. Fossil fuel energy consumption and renewable energy consumption reduce pollution at high-quantile levels in Asian continent. The results reflect that greenhouse gas emissions are highly sensitive to the independent variables in the model. While creating strategies for environmental problems, solutions through the financial system should also be taken into account. Banking sector should not facilitate firms that cause carbon emissions. More attention can be paid to the tourism sector. Governments should create strategies to support the renewable energy sector through financial markets. Promoting longer-term investment by institutional investors could be appropriate.

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The authors contributed equally to the article.

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