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Tourism Development, Governance and CO_2 Emissions in 28-EU Countries

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ABSTRACT

Although several studies have assessed the influence of tourism on CO_2 emissions, the moderating impact of governance quality on the tourism-CO_2 emissions nexus is quite sparse. To fill this gap in the literature, this study examines the moderating effect of governance quality on the tourism-CO_2 emissions nexus in 28 European Union countries over the period 2004–2019. To achieve this goal, the dynamic ordinary least squares (DOLS) estimation technique is used. The results show that tourism has a significant positive impact on CO_2 emissions. This implies that as tourism increases, CO_2 emissions also increase. Moreover, the impact of governance quality on CO_2 emissions is negative and statistically significant. This indicates that an improvement in governance quality could contribute to lessen CO_2 emissions. Interestingly, the results reveal that the interaction term of tourism and governance quality has a significant negative impact on CO_2 emissions. This implies that governance quality matters for tourism to promote environmental quality.

1 | Introduction

It has been widely recognized that tourism plays a significant role in promoting economic growth. For instance, tourism has been found to contribute to the promotion of economic growth through international trade (Ahmad et al. 2019). Moreover, the authors posit that the vacuum of unemployment can be filled by tourism. Similarly, it is widely believed that tourism can contribute to mobilize domestic resources. Accordingly, international investments could be propelled by tourist arrivals. In the same vein, the tourism-led growth nexus has been supported by Rasool et al. (2021), who argued that tourism has the potential to stimulate investments in infrastructure. Moreover, tourism has been established to accelerate and improve human capital development (Wang and Tziamalis 2023).

Recently, the positive relevance of tourism on economic prosperity has been translated into socio-economic development. For example, Folarin and Adeniyi (2019) have examined the influence of tourism on poverty reduction. Similarly, Nguyen et al. (2020) and Lv (2019) have shown the positive effect of tourism on income distribution. Likewise, Garcia and Porto (2021) have investigated the positive influence of tourism on the creation of jobs. Salinas et al. (2021) have examined and shown how

tourism could contribute to lessening the informal economy. In fact, there is a growing strand of literature on the relevance of tourism in inclusive and sustainable development outcomes (Voumik et al. 2023; Martial et al. 2023; Uddin et al. 2024; Rahman et al. 2024). Moreover, there is also an evolving strand of literature on the role of governance in the nexus between the informal economic sector, the formal economic sector and environmental pollution (Dada et al. 2021; Dada and Ajide 2021; Dada et al. 2022). As clarified in Section 2.4, governance is understood in terms of three main dimensions, namely, political governance, economic governance and institutional governance. These three dimensions are consistent with the categorization of governance indicators by the World Bank and the extant governance literature (Tchamyou 2021).

Despite its positive influence on economic growth, the creation of jobs, poverty reduction and income distribution, tourism has been widely criticized for contributing to CO_2 emissions (Paramati et al. 2017). Recently, information gleaned from UNWTO (2020) indicates that tourism contributes to CO_2 emissions by 8%. Lenzen et al. (2018) have identified the channels through which tourism contributes to environmental degradation (CO_2 emissions). Notable channels include goods (12%), food and beverages (10%), agriculture (8%), services (8%), lodgings (6%), construction and mining (6%) and others (1%) (Fava 2020). It has been argued that the main factor that contributes to CO_2 emissions in the tourism sector is transport, namely, aeroplanes, vehicles and motorcycles (Teodros 2020). According to Gössling et al. (2015), 49% of the emission is produced during travels. Theoretically, it has been argued that the energy consumption related to transportation contributes to increasing the amount of CO_2 emissions, thereby worsening environmental degradation. Although a sizeable literature has assessed the influence of tourism on environmental degradation, the existing studies remain mixed and controversial (Zhang and Zhang 2020). Some scholars argue that tourism contributes to exacerbating environmental degradation (Lee et al. 2021), whereas others conclude that tourism could contribute to lessening CO_2 emissions (Lv and Xu 2021; Paramati et al. 2018).

The disagreement among previous studies could be traceable to many reasons, namely, the use of different indicators of tourism development (international tourism receipts, number of arrivals, inter alia), different econometric methods and/or varying explanatory variables. Furthermore, recent studies have argued that the nexus between tourism and environmental degradation might be non-linear. For example, Ehigiamusoe (2020) found a U-shaped nexus between tourism and environmental degradation in 31 African countries. Contrary, Lv and Xu (2021) have revealed an inverted U-shaped linkage between tourism and environmental degradation. A lack of consensus among previous studies compels us to examine the relationship between tourism and environmental degradation with additional indicators such as governance variables, which are discussed at the end of the introduction in the light of the extant literature and further substantiated in Section 2.4 within the remit of a conceptual or schematic framework. Accordingly, Tovar and Lockwood (2008) revealed that environmental quality depends on the government's effort to promote sustainable tourism.

A considerable number of studies have argued that governance quality matters for economic growth, tourism development and environmental quality (Danish and Ulucak 2020; Nathaniel et al. 2021; Usman et al. 2019). For instance, Heckelman and Powell (2010), Ahmad et al. (2021) and Verbeke and De Clercq (2006) posited that good governance, the level of democracy and respect of the rule of law could influence industries, firms, consumers and other economic agents by improving environmental performance. As tourism is widely associated with trade liberalization, Ibrahim and Law (2016) and Ibrahim and Ajide (2020) document that good governance could favourably improve environmental performance through trade openness. In the same spirit, Ozturk et al. (2019) reveal that lowering corruption could contribute to energy efficiency, thereby promoting environmental quality. Usman et al. (2019) have noted that governance quality improves environmental quality. Furthermore, the authors insist that this could be realized due to economic instruments such as taxes and subsidies. Despite these arguments, studies are sparse on the moderating effect of governance quality on the tourism-CO_2 emissions nexus.

The stylized facts justifying the positioning of the present study on 28 European countries are provided in Section 2.1. Accordingly, the specific objectives of the present are to: (i) examine the impact of tourism and governance quality on CO_2 emissions and (ii) assess the moderation of governance quality on the tourism-CO_2 emissions nexus. In the light of the objectives of the study, the corresponding research question this study aims to answer is the following: what is the role of governance quality in the tourism-CO_2 emissions nexus in 28 European Union (EU) countries? In other words, what are the direct and indirect effects of tourism on CO_2 emissions, granting that there is a moderating role of governance quality in 28 EU countries?

Based on the above objectives, the present article makes contributions to the existing literature. First, it departs from Muhammad et al. (2021), who examine the impact of foreign direct investment, tourism and governance on energy consumption and CO_2 emissions. However, this study differs by investigating the moderation of governance quality on the tourism-CO_2 emissions relationship. Moreover, unlike the study of Muhammad et al. (2021), which has used the principal component analysis to get the average of governance, this study uses all governance indicators because they all matter in the process of tourism development. Unfortunately, these studies have failed to assess the moderation of governance quality in the tourism-CO2 emissions nexus.

Second, as posited by the theoretical literature, the interactive model can be used to examine the moderation of the policy variable in linkages involving more than two variables of interest (Brambor et al. 2006). For example, Ehigiamusoe (2020) has used this framework to examine the moderation of economic growth in the tourism-CO_2 emissions nexus.

In the light of the above, a number of studies have evaluated the relationship between tourism and CO_2 emissions; nevertheless, there is a dearth of research on the moderating effect of governance quality on this relationship. In order to close this gap in the literature, this study looks at how governance quality moderates

the relationship between tourism and CO_2 emissions in 28 EU nations between 2004 and 2019. The dynamic ordinary least squares (DOLS) estimate approach is employed to accomplish this aim. The findings demonstrate that tourism significantly increases CO_2 emissions. This implies that CO_2 emissions rise in tandem with tourism. Furthermore, there is a negative and statistically significant relationship between governance quality and CO_2 emissions. This suggests that lowering CO_2 emissions may be facilitated by an improvement in governance quality. Furthermore, CO_2 emissions are negatively impacted by the interaction between tourism and governance quality. This indicates that for tourism to support environmental quality, governance quality is important.

2 | Stylized Facts, Empirical Literature and Conceptual Framework

2.1 | Stylized Facts

The study focuses on 28 European countries due to several reasons. According to UNWTO (2018), Europe accounts for 50% of tourist arrivals in the globe, and it has been classified as the most visited region in the world. According to the 2019 EU Tourism Trends Report, about 50% of the top 10 destinations globally are located in the EU (Europe Statistics 2024). In line the same source, in Europe, international arrivals increased from 670 million in 2017 to 713 million in 2018 (Europe Statistics 2024). Likewise, Usman et al. (2019) documented that the number of jobs created in the tourism sector has increased from 14 million direct employment avenues in 2017 to 14.4 million in 2018. However, the positive effect of tourism on economic growth has negatively affected environmental quality in Europe (Le and Nguyen 2020). Despite a recent effort to decrease CO_2 emissions in Europe, the problem of climate change still remains (see Figure A1). As revealed by the European Parliamentary Research Service, transport is a major driver of climate change in the region. According to their investigation, tourism amplifies this trend (EPRS 2021). As shown in Figure 1, governance appears to be strong in the EU.

2.2 | Linkage Between Tourism and CO_2 Emissions

Theoretically, Koçak et al. (2020) have identified several channels through which tourism contributes to environmental degradation. First, tourism can deepen environmental degradation through the international tourism trip channel. According to Gössling et al. (2015), the tourism sector is heavily related to all aspects of fossil resources, namely, oil, natural gas and coal. Sharif et al. (2020) have documented that these fossil resources are used for transportation, accommodation and destination activities. It has been argued that airline travels have been increased in recent years (Dogan and Aslan 2017). Underlying this argument, it has been concluded that the aviation sector has significantly contributed to global CO_2 emissions. In the same context, Koçak et al. (2020) have reckoned that tourism exacerbates environmental degradation because it is associated with the import of food and other material goods that require significant energy. Similarly, Wan and Brahmasrene (2013) have documented that tourism could contribute to worsening environmental degradation through poor preparation to handle tourists. Second, tourism investments have been seen as a major contributor to environmental degradation due to changes in land-use. According to Koçak et al. (2020), land-use change has harmed environmental quality as forest areas have decreased.

2.3 | Linkage Between Governance Quality and CO_2 Emissions

Theoretically, it has been argued that governments can spur economic prosperity via expenditure and governance quality (Barro 1990; Perera and Lee 2013). On the basis of this argument, institutional economists have shown the positive contributions of governance quality to economic growth (Acemoglu et al. 2004; North 1989, 1990). Unfortunately, the linkage between governance quality and environmental quality has received less attention from scholars and policy makers (Le and Ozturk 2020). As highlighted by Ostrom (1998), environmental regulation should be a priority of the government. Furthermore, the author argued that this regulation's success depends on the governments' structure and efficiency that are largely appreciated in terms of governance quality. According to Frankel and Romer (1999), environmental quality could be fostered by governance quality through a strong judicial system that can create effective mechanisms for capital and information allocation and attract foreign investment.

2.4 | Conceptual Framework

The conceptual framework is consistent with Akpa et al. (2024), on the role of governance in the nexus between internet penetration and financial inclusion. It is relevant to note that the conceptual framework in the study builds on the interactions between variables used in the study. The conceptual framework is a schematic diagram that links the various concepts or variables employed in the study. We borrow from Akpa et al. (2024), who have employed the same conceptual framework within the remit of interactive regressions. The present study is also based on interactive regressions.

The problem statement's underlying schematic architecture or conceptual framework is displayed in Figure 2 below. As a result, as the chart illustrates, the moderating variable of governance influences how tourism affects CO_2 emissions. Thus, the primary channel is tourism, the outcome variable is CO_2 emissions, and the moderators are the dynamics of governance with respect to political, economic and institutional governance. It is noteworthy to mention that although the literature review discussed prior has shown a direct relationship between good governance and CO_2 emissions, suggesting that a direct pathway between governance and CO_2 emissions may exist in the model, this study's contribution to the literature reviewed is what motivates the adoption of governance as a moderator.

Through the growth of tourism, there is an innate connection between CO_2 emissions and all forms of governance. According to Tchamyou (2021), the related governance variables are established using the World Bank's World Governance Indicators

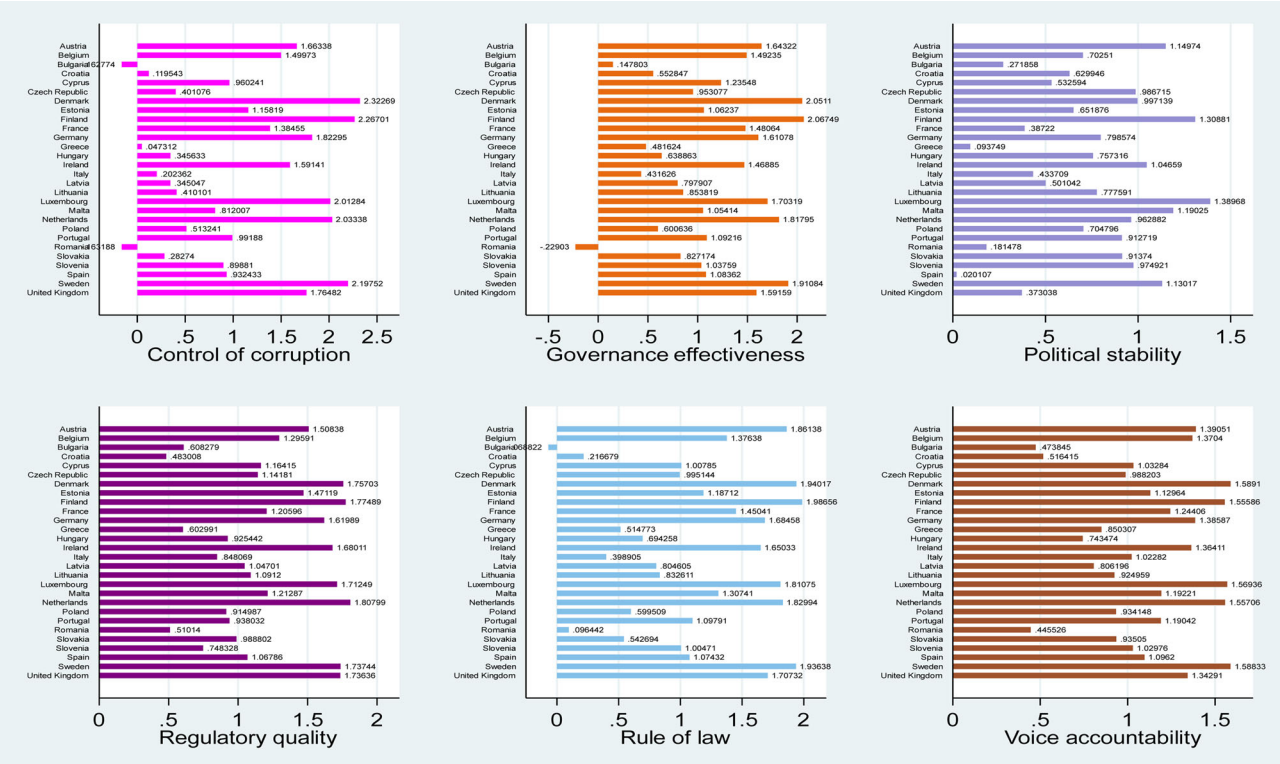

FIGURE 1 | Average within-country governance in 28-EU countries, 2004–2019. Authors' computation based on data from World Governance Indicators (WGIs) of the World Bank. [Colour figure can be viewed at wileyonlinelibrary.com]

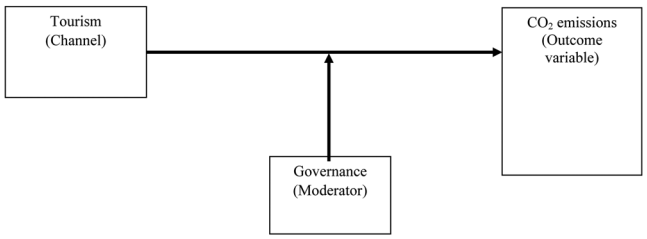

FIGURE 2 | Schematic framework. [Colour figure can be viewed at wileyonlinelibrary.com]

(WGIs) as a guide. First, it is anticipated that political governance, that is, political stability and the absence of violence, will have an impact on tourism. This is because violent and unstable political periods often have an impact on tourism development, which in turn affects CO_2 emissions (Jaisinghani et al. 2024). It is important to recall that the election and removal of political leaders are central to the concept of political governance (Tchamyou 2021).

Second, the development of tourism in a country is clearly influenced by effective economic governance, which is measured by the quality of regulations and the effectiveness of the government. These interactions in turn have an impact on environmental outcomes like CO_2 emissions. This is because economic governance is defined as the formulation and execution of policies that provide public goods like leisure activities related to tourism (Ullah et al. 2024). Third, a strong politico-economic environment where the State and the people respect the institutions that regulate their interactions is known as institutional governance (i.e., represented by the rule of law and corruption control) (Ullah et al. 2024). Thus, well-run institutions refrain from allowing a small number of people to appropriate public funds that could be used to reduce the carbon footprint of initiatives aimed at boosting the travel and tourism industry.

The underlying narrative leads to the following testable hypotheses:

Hypothesis 1. *Tourism increases CO_2 emissions.*

Hypothesis 2. *Governance mitigates the positive nexus between tourism and CO_2 emissions.*

3 | Model Specification, Data and Methodology

3.1 | Model Specification

This study borrows a classical specification from the literature dealing with tourism and energy economics, especially is it pertains to the direct link between the environment and tourism on the one hand and the nexus between the environment and governance on the other hand (Li and Lv 2021; Lv and Li 2021; Lv and Xu 2021). The corresponding bivariate specifications are in the following equations, respectively:

$$ENV_{it} = \alpha_0 + \alpha_1 Tour_{it} \quad (1)$$

$$ENV_{it} = \alpha_0 + \alpha_1 INST_{it} \quad (2)$$

According to Caglar et al. (2022), Shahbaz et al. (2022), Agozie et al. (2022), Gyamfi et al. (2022) and Le and Nguyen (2020), several channels, namely, industrialization, urbanization, trade openness, economic growth and foreign direct investment, could positively or negatively affect environmental quality. Moreover, Grossman and Krueger (1991) established the U-shaped nexus between economic growth and environmental quality. Therefore, the baseline model can be specified in the following equation:

$$ENV_{it} = \alpha_0 + \alpha_1 GDPpc_{it} + \alpha_2 GDPpc_{it}^2 + \alpha_3 industry_{it} + \alpha_4 urban_{it} + \alpha_5 TOP_{it} + \alpha_6 FDI_{it} + \alpha_7 ENG_{it} + \mu_i + \varepsilon_{it} \quad (3)$$

To capture the combined effect of tourism and governance quality on environmental degradation, Equation (3) can be extended as follows:

$$ENV_{it} = \alpha_0 + \alpha_1 GDPpc_{it} + \alpha_2 GDPpc_{it}^2 + \alpha_3 industry_{it} + \alpha_4 urban_{it} + \alpha_5 TOP_{it} + \alpha_6 FDI_{it} + \alpha_7 ENG_{it} + \alpha_8 Tour_{it} + \alpha_9 INST_{it} + \alpha_{10}(Tour \times INST)_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

where ENV is the environmental degradation, which is CO_2 emissions in kt; GDPpc is the gross domestic product per capita; $GDPpc^2$ is the square of gross domestic product per capita; industry is the industrialization, which is the industry (including construction) value added (% GDP); urban is urbanization, which is urban population (% of total population); TOP is the trade openness, which is trade (% GDP); FDI is the foreign direct investment (% GDP); ENG is the energy consumption; Tour is international tourism (number of arrivals); INST is governance quality (governance effectiveness, rule of law, regulatory quality, voice & accountability, corruption-control and political stability); $Tour \times INST$ is the interaction term of tourism and governance quality; $i = 28$ countries; $t = 2004.....2019$; ε_{it} = error term. It is important to note that all variables excluding foreign direct investment and governance quality indicators are in natural logarithm form. This is because only foreign direct investment and governance variables are in single digit units, as apparent in the descriptive statistics in Table 1. Hence, in order for the mean values of the variables to be comparable, the remaining variables are normalized with logarithms.

Considering Equation (4), the net effect of tourism on environment degradation can be determined as follows in the following equation:

$$\frac{\partial ENV_{it}}{\partial Tour_{it}} = \alpha_8 + \alpha_{10}\overline{INST_{it}} \quad (5)$$

where $\overline{INST}$ is the mean value of governance quality.

The underlying insights into the computation of net effect are in line with contemporary literature on interactive regressions (Asongu and Odhiambo 2020).

3.2 | Data

This study uses secondary data from a panel of 28 EU countries[1] over the period 2004–2019. The use of this scope is dictated by the availability data. Several sources of data are used to accomplish this study. The data on urbanization, industrialization, foreign direct investment, CO_2 emissions, trade openness, gross domestic product per capita and international tourism arrivalsare sourced from the World Development Indicators (WDIs) of the World Bank. Furthermore, the data on governance quality indicators (governance effectiveness, regulatory quality, rule of law, political stability, control of corruption and voice & accountability) are obtained from the WGIs of the World Bank.

3.3 | Justification of the Variables in the Model

3.3.1 | Economic Growth (GDP)

It is crucial to consider economic growth in this model (Ehigiamusoe et al. 2023). According to the authors, economic growth has been established to intensify environmental degradation through increasing energy consumption and CO_2 emissions in recent years. Following this argument, some studies found that economic growth contributes to undermining environmental quality (Gyamfi et al. 2021; Salari et al. 2021).

3.3.2 | Urbanization

Theoretically, urbanization has been found to promote economic growth which by extension could undermine environmental quality (Chen et al. 2022). Moreover, urbanization implies the improvement of urban cities which require more energy (Gyamfi 2022). As such, it will contribute to worsening environmental degradation. Moreover, urbanization can also boost innovation which could contribute to reduce CO_2 emissions and thus improve environmental quality. Therefore, urbanization may have a positive or negative impact on environmental quality.

3.3.3 | Industrialization

Industrialization logically propels economic growth. Promoting industrialization in a country requires more energy, which might contribute to increase CO_2 emissions and thus undermine environmental quality (Opoku and Aluko 2021; Opoku and Boachie 2020). According to Opoku and Boachie (2020), industrialization is energy intensive. Therefore, promoting industrialization could exacerbate environmental degradation.

3.3.4 | Foreign Direct Investment

Theoretically, foreign direct investment has been shown to have a positive impact on economic growth (Asongu and Odhiambo 2020). However, such positive impact of foreign direct investment is at the expense of environmental degradation. For example, Opoku and Boachie (2020) and Agboola et al. (2022) have established that foreign direct investment can undermine environmental quality by promoting industrialization. However, foreign direct investment could promote environmental quality via innovation. In the light of the above, foreign direct investment may therefore affect environmental quality positively or negatively.

3.3.5 | Trade Openness

Theoretically, trade has been shown to propel economic growth (Asongu and Odhiambo 2020), which by extension could undermine environmental quality. According to the explanation given by Dauda et al. (2021) and Gyamfi et al. (2023), trade has the potential to attract some companies in host countries which could worsen environmental degradation through industrial pollution. Following this argument, trade openness may have a negative impact of environmental quality.

3.3.6 | Energy Consumption

Energy consumption has been added in our model because studies have posited that environmental degradation could be influenced by energy consumption (Ehigiamusoe et al. 2023). According to the authors, the energy used in the improvement of agricultural development, industrialization and economic activities boost environmental degradation. For example, Ehigiamusoe et al. (2023) found that energy consumption in Malaysia undermine environmental quality. Contrary, energy can enhance environmental quality if the energy used is clean. Therefore, energy consumption may have a positive or negative impact on environmental quality.

3.4 | Estimation Strategy

Until 2019, the United Kingdom and 27 other EU countries continued to share the same values in terms of demography, economic integration, markets and politics. As these countries are interconnected, Ahmad et al. (2021) argued that examining the cross-sectional dependence (CD) is important. Therefore, we employ Pesaran (2004) to achieve this goal. As revealed in Table A1, all variables used in this study are significant, meaning that there is a CD. Furthermore, Adeola and Evans (2020) documented that the presence of CD requires a unit root test. Likewise, Ehigiamusoe (2020) has argued that it is important to examine the unit root test to avoid spurious results. Hence, we employ Pesaran (2007) to examine the unit root test. As shown in Table A2, the panel contains a unit root. Moreover, we engage Kao (1999) to examine a cointegration relationship among the variables. As revealed in Table A3, all variables are cointegrated. As all variables are cointegrated, it is important to use an estimation technique that is suitable for cointegrated panels. Therefore, we employ the DOLS estimation (Wu 2024) to examine the joint effect of tourism and governance quality on environmental degradation.

Furthermore, to account for CD, the panel corrected standard errors (PCSE) estimation technique which is developed by Jönsson (2005) is employed, not least because it is appropriate in such a context.

4 | Results and Discussion

4.1 | Descriptive Statistics and Correlation Matrix

Tables 1 and 2 show the descriptive statistics and correlation matrix. Asshown in Table 1, the mean value of environmental degradation (CO_2 emissions) is 128,858.3 kt. According to Figure 3 Germany has been ranked as the most polluted country in the region, whereas Malta is the last country in terms of pollution. Moreover, the mean value of international tourism arrivals is 2.97e + 07. As shown in Figure 4, France recorded the highest value, whereas Luxembourg registered the lowest value. Likewise, the mean values of control of corruption, governance effectiveness, political stability, regulatory quality, rule of law and voice & accountability are 1.023, 1.123, 0.742, 1.200, 1.126 and 1.116, respectively. It means that governance quality is strong in EU countries.

TABLE 1 | Descriptive statistics.

Variables	Mean	Std. dev.	Min	Max
CO_2 emissions	128,858.3	178,002.1	1342.122	816,721.6
Gross domestic product	16,487.5	20,470.82	286.49	93,777.11
Trade openness	88.639	37.082	29.748	347.996
Foreign direct investment	7.8142	25.099	−25.108	280.131
Urbanization	62.176	21.281	16.208	100
Industrialization	26.355	11.816	3.720	84.349
Energy	3509.681	1480.092	1591.668	9428.811
Tourism	2.97e + 07	4.16e + 07	805,000	2.12e + 08
Control of corruption	1.023	0.787	−0.295	2.469
Government effectiveness	1.123	0.587	−0.359	2.353
Political stability	0.742	0.391	−0.473	1.620
Regulatory quality	1.200	0.433	0.148	2.047
Rule of law	1.126	0.608	−0.174	2.100
Voice & accountability	1.116	0.344	0.220	1.800

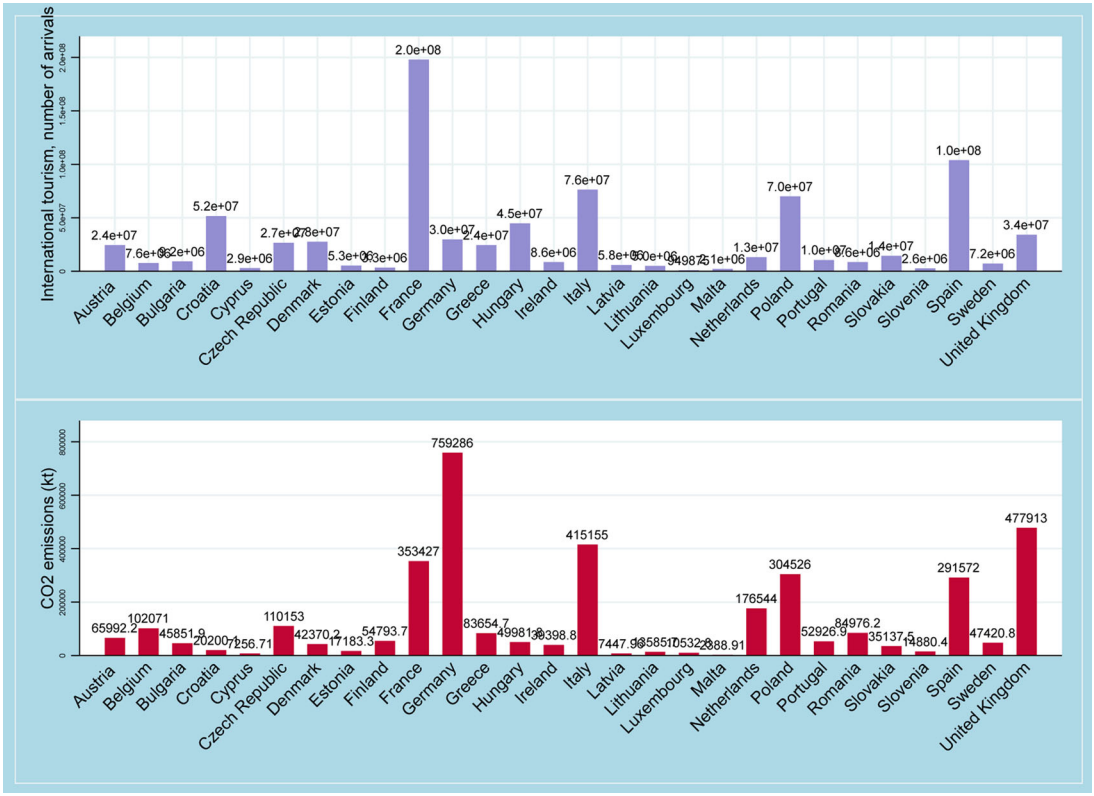

FIGURE 3 | Average within-country tourism and CO_2 emissions in 28-EU countries, 2004–2019. Authors' computation based on data from World Development Indicators (WDIs) of the World Bank. [Colour figure can be viewed at wileyonlinelibrary.com]

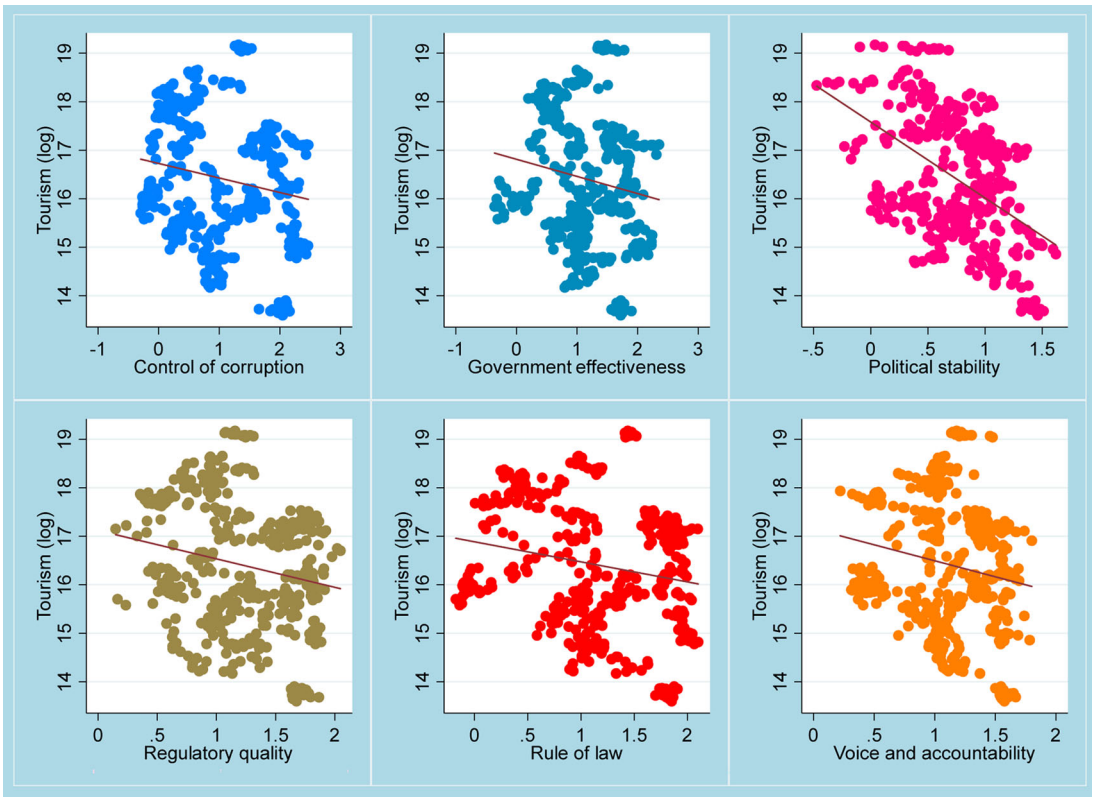

FIGURE 4 | Tourism—Governance Quality Nexus, 2004–2019. Authors' computation based on data from World Governance Indicators (WGIs) and World Development Indicators (WDIs) of the World Bank. [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 2 | Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
(1)ENV	1													
(2)GDP	−0.101	1												
(3)Trade openness	−0.0577	0.388***	1											
(4)FDI	−0.111	0.151*	0.184**	1										
(5)Urbanization	0.0233	0.795***	0.494***	0.0796	1									
(6)Industrialization	0.181**	−0.220***	−0.0816	−0.220***	−0.255***	1								
(7)Energy consumption	0.144*	0.169**	0.131*	−0.114	0.0678	−0.399***	1							
(8)Tourism	0.736***	−0.0330	−0.0106	0.123*	0.0551	0.124*	−0.238***	1						
(9)Control of corruption	−0.123*	0.217***	−0.0310	−0.172**	0.0760	−0.225***	0.707***	0.161**	1					
(10)Government effectiveness	0.0767	0.211***	−0.0322	−0.109	0.0894	−0.261***	0.707***	0.124*	0.348***	1				
(11)Political stability	−0.360***	0.187**	−0.00695	−0.0501	0.0646	−0.249***	0.543***	0.490***	0.339***	0.585***	1			
(12)Regulatory quality	0.111	0.201***	−0.0622	−0.231***	0.0693	−0.191**	0.669***	0.152**	0.495***	0.573***	0.521***	1		
(13)Rule of law	0.0570	0.214***	−0.0749	−0.207***	0.0914	−0.201***	0.666***	0.174**	0.650***	0.447***	0.598***	0.920***	1	
(14)Voice & accountability	−0.135*	0.151*	−0.00524	−0.245***	0.118*	−0.226***	0.725***	0.150*	0.529***	0.415***	0.596***	0.888***	0.937***	1

Note: *, ** and *** are significant levels at 10%, 5% and 1%, respectively.
Abbreviations: FDI, foreign direct investment; GDP, gross domestic product.

From the correlation matrix disclosed in Table 2, the result unveils a positive correlation between tourism and environmental degradation, indicating that tourism might contribute to environmental degradation in selected countries. The result also shows a negative correlation between governance quality and environmental degradation, indicating that governance quality can be used to promote environmental quality. Additionally, the estimated results show a positive correlation between tourism and governance quality (see Figure A1).

4.2 | Bivariate Results on Effects of Tourism and Governance Quality on Environmental Degradation

Table 3 presents the bivariate results on environmental degradation and the variables of interest—tourism and governance quality indicators.

First, as disclosed in Table 3, the influence of tourism on environmental degradation is positive and statistically significant. Second, the relationship between environmental degradation and governance quality indicators (rule of law, control of corruption, regulatory quality, political stability and voice accountability) is negative and statistically significant.

4.3 | The Influence of Tourism and Governance Quality on Environmental Degradation in 28 EU Countries

Table 4 discloses the joint effect of tourism and governance quality on environmental degradation using the DOLS estimation technique.

As shown in the baseline (see column [1]), the influence of economic growth on environmental degradation is positive and statistically significant. In contrast, the impact of its squared term on environmental degradation is negative and statistically significant. This implies that economic growth and environmental degradation have an inverted U-shaped relationship. Economically speaking, at the initial stage of economic development, environmental degradation increases, but after reaching a certain threshold, it will promote environmental quality through new technology development and innovation. The results are consistent with Grossman and Krueger (1991), who pioneered the Environmental Kuznets Curve (EKC).

Similarly, the result shows that the estimated coefficient of industrialization is positive and statistically significant, meaning that as industrialization increases, environmental degradation also increases. Le and Nguyen (2020) documented that in the pre-industrialization era, agriculture generally dominates the economy and its related activities (which are characterized by less energy intensity). However, as industrialization takes shape, it contributes to exacerbating environmental degradation through the rapid growth of energy demand and consumption. For example, Le and Nguyen (2020) posited that industrialization contributes to worsening environmental degradation through manufacturing sectors which consume more energy. Similarly, Opoku and Aluko (2021) highlighted the negative effect of industrialization on environmental quality through export diver-

TABLE 3 | The bivariate relationships between environmental degradation and the variables of interest—tourism and governance quality indicators (Baseline OLS).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tourism	0.802***						
	(0.040)						
Control of corruption		−0.250***					
		(0.092)					
Government effectiveness			−0.181				
			(0.122)				
Political stability				−1.015***			
				(0.176)			
Regulatory quality					−0.361**		
					(0.172)		
Rule of law						−0.204*	
						(0.119)	
Voice & accountability							−0.655***
							(0.214)
Constant	−2.169***	10.64***	10.70***	11.67***	10.46***	10.67***	10.16***
	(0.661)	(0.120)	(0.157)	(0.151)	(0.220)	(0.154)	(0.251)
Observations	338	360	360	360	360	360	360
R-squared	0.539	0.020	0.006	0.084	0.012	0.008	0.025
Adjusted *R*-Squared	0.538	0.017	0.003	0.082	0.009	0.005	0.022

Note: Standard errors in parentheses;
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

sification, which increases energy consumption. Our finding is consistent with Le and Nguyen (2020) for 95 economies over the period 1998–2014. Similarly, this finding is in line with Lv and Li (2021), who found that a 1% increase in industrialization is associated with an increase in environmental degradation by 0.106%.

In the same vein, energy consumption has a positive and statistically significant influence on environmental degradation, meaning that a percent increase in energy consumption is associated with an increase in environmental degradation by 0.421%. As most of the EU countries are industrialized, they consume more energy, which contributes to environmental degradation through CO_2 emissions. Similar results were found by Zhang and Zhang (2020), who highlighted the positive contribution of energy consumption to environmental degradation in China.

The isolated or direct effects of our independent variables of interest (tourism and governance quality indicators) (see from Column [2] to Column [8]) are first taken into account before the corresponding interactive effects (from Column [9] to Column [14]). As shown in Column [2], the coefficient of tourism is positive and statistically significant; a 1% increase in tourism contributes to worsening environmental degradation by 0.875%. As discussed earlier, tourism could contribute to environmental degradation through attraction centres, ski destinations, theme parks and international tourism trips. According to Zha et al. (2020), attraction centres, ski destinations and theme parks are related to the use of high energy, which could in turn contribute to exacerbating CO_2 emissions and environmental degradation. Similar outcomes were found by Ehigiamusoe (2020) who used 31 African countries as well as the fully modified ordinary least squares (FMOLS) estimation approach to examine the influence of tourism on environmental degradation. Moreover, our results are in line with Muhammad et al. (2021), who found that tourism undermines environmental quality in Muslim nations.

As tourism contributes to environmental degradation, it needs government action. We therefore add the interaction term of tourism and governance quality (see from Column [9] to Column [14]). As a result, the interaction term of tourism and governance quality appears to have a negative and statistically significant effect on environmental degradation. This means that the complementarityof governance quality remains important for the tourism-environmental quality nexus. For example, governments could encourage foreign investors (tourism sector) to invest in research and development (R&D), which could contribute to promoting sustainable tourism and lessening environmental degradation. Moreover, governance quality matters for the tourism sector to reduce environmental degradation through the regulation of law. In the same vein, governance quality matters for the tourism sector to lessen environmental degradation through the use of electric transport such electric motorbikes and electric cars. The net effects of tourism on environmental degradation are

TABLE 4 | Dynamic ordinary least squares (DOLS) results on the influence of tourism and governance quality on environmental degradation (dependent variable: CO_2 emissions).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Gross domestic product per capita	1.606***	0.869***	6.114***	1.324***	2.162***	0.878***	1.610***	1.558***	5.812***	5.127***	0.922***	2.870***	3.419***	5.535***
	(0.155)	(0.149)	(0.146)	(0.151)	(0.155)	(0.155)	(0.154)	(0.155)	(0.122)	(0.145)	(0.140)	(0.142)	(0.135)	(0.148)
Square of gross domestic product per capita	−0.0866***	−0.0174*	−0.318***	−0.0684***	−0.118***	−0.0457***	−0.0892***	−0.0770***	−0.280***	−0.242***	−0.0730***	−0.124***	−0.157***	0.259***
	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Industrialization	0.681***	0.933***	1.852***	1.098***	0.371***	0.716***	0.919***	1.087***	1.578***	1.576***	0.693***	1.032***	1.106***	1.400***
	(0.060)	(0.058)	(0.056)	(0.058)	(0.061)	(0.060)	(0.060)	(0.060)	(0.047)	(0.057)	(0.057)	(0.059)	(0.053)	(0.059)
Urbanization	0.102	1.895***	2.399***	1.006**	0.00566	0.240	0.822*	1.160**	3.465***	3.497***	1.105**	2.618***	2.600***	3.526***
	(0.479)	(0.462)	(0.459)	(0.464)	(0.478)	(0.489)	(0.484)	(0.487)	(0.384)	(0.460)	(0.430)	(0.473)	(0.475)	(0.497)
Trade openness	−1.181***	−1.191***	−1.424***	−1.352***	−1.523***	−1.278***	−1.456***	−1.306***	−1.636***	−1.660***	−1.082***	−1.646***	−1.604***	−1.354***
	(0.479)	(0.057)	(0.056)	(0.058)	(0.059)	(0.059)	(0.059)	(0.059)	(0.045)	(0.056)	(0.052)	(0.054)	(0.051)	(0.056)
Foreign direct investment	−0.00244	−0.0116***	−0.0515***	−0.0322***	−0.0213***	−0.00223	−0.0249***	−0.0136***	−0.00309**	−0.0120***	−0.000507	−0.0126***	−0.00415**	−0.0109***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Energy consumption	0.421***	1.998***	1.487***	0.644***	0.478***	−0.216	0.495***	0.285**	3.406***	3.864***	1.869***	2.994***	2.951***	3.220***
	(0.133)	(0.135)	(0.1315)	(0.134)	(0.140)	(0.138)	(0.132)	(0.136)	(0.115)	(0.136)	(0.134)	(0.135)	(0.122)	(0.137)
Tourism		0.875***							0.361***	0.124*	0.287***	0.222***	0.298***	−0.0827
		(0.045)							(0.061)	(0.071)	(0.051)	(0.078)	(0.091)	(0.093)
Control of corruption			−1.304***						−7.040***					
			(0.052)						(0.474)					
Government effectiveness				−0.985***						−11.18***				
				(0.054)						(0.646)				
Political stability					−1.347***						1.125*			
					(0.048)						(0.609)			

(Continues)

TABLE 4 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Regulatory quality						−0.512***						−6.964***		
						(0.064)						(0.773)		
Rule of law							−1.242***						−8.310***	
							(0.079)						(0.894)	
Voice & accountability								−1.423***						−15.20***
								(0.087)						(0.980)
Tourism × control of corruption									−0.471***					
									(0.028)					
Tourism × governance effectiveness										−0.597***				
										(0.0387)				
Tourism × political stability											−0.412***			
											(0.035)			
Tourism × regulatory quality												−0.369***		
												(0.046)		
Tourism × rule of law													−0.445***	
													(0.052)	
Tourism × voice & accountability														−0.793***
														(0.058)
Observations	128	120	128	128	128	128	128	128	120	120	120	120	120	120
Wald test	1162.07***	1957.19***	5182.99***	1218.88***	2509.85***	1088.61***	1157.63***	1014.74***	9985.99***	5630.41***	1883.28***	3539.80***	4397.76***	5432.81***

Note: Standard errors in parentheses;
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

−0.121, −0.55, −0.019, −0.221 and −0.203 for control of corruption, government effectiveness, political stability, regulatory quality and rule of law, respectively.

Regarding other variables, the results unveil that the impact of foreign direct investment on environmental degradation is negative and statistically significant. This means that as foreign direct investment increases, environmental degradation decreases. This corroborates the findings of Teng et al. (2021), who argued that the involvement of foreign direct investment in R&D could contribute to lessening environmental degradation. However, the results indicate that the coefficient of urbanization is positive and statistically significant, meaning that an increase in urbanization could lead to environmental degradation. As urbanization is conflated with the growth of large cities (Tacoli 2017), urbanization could contribute to deepening environmental degradation through economic activities. Similarly, the results show that energy consumption contributes to aggravating environmental degradation.

4.4 | Robustness Check

4.4.1 | Robustness Check 1

As 28 EU countries are cross sectionally-dependent (see Table A1), we employ the PCSE estimation approach developed by Jönsson (2005) to account for cross sectional dependence. The results shown in Table 5 are consistent with the DOLS estimation results. More precisely, economic growth has an inverted U-shaped impact on environmental degradation. Moreover, the coefficients of tourism, urbanization, industrialization and energy consumption are positive and statistically significant, indicating their detrimental effect on environmental degradation. However, the coefficients of trade openness, foreign direct investment and governance quality are negative and statistically significant, signifying their positive effect on environmental quality. Similarly, the coefficient of the interaction term of governance quality and tourism is negative and statistically significant. This implies that governance quality matters for tourism to promote environmental quality. The net effects of tourism on environmental degradation are −0.491, −0.15, −0.17, −0.18, −0.09 and −0.29 for, respectively, government effectiveness, political stability, regulatory quality, rule of law, voice & accountability, and control of corruption.

The key theoretical implication is that the associated theories should not be mainly seen as linking macroeconomic components in a linear fashion in order to enhance theoretical comprehension. This is crucial because the empirical findings presented in this study support both the theoretical positions that suggest a negative relationship contingent on higher levels of governance quality (Frankel and Romer, 1999) and a positive relationship contingent on lower levels of governance in the tourism industry (Wan and Brahmasrene 2013; Koçak et al. 2020; Nguyen and Dinh Su 2021).

5 | Conclusion and Policy Recommendations

5.1 | Conclusion

Although several studies have used a time series technique to examine the relationship between tourism and CO_2 emissions, the nexus between tourism and CO_2 emissions using panel data has not been extensively studied. Moreover, although the relationship between tourism and environmental degradation has been extensively examined, studies on the joint effect of tourism and governance quality on environmental degradation are sparse. This study addresses the information gap by assessing the moderating effect of governance quality on the nexus between tourism and environmental quality in 28 EU countries over the period 2004–2019. To this end, the DOLS technique has been used.

The key results show that tourism has a positive and statistically significant impact on environmental degradation. This finding highlights that an increase in international tourism arrivals exacerbate environmental degradation. However, the results also show that the impact of governance quality on environmental quality is negative and statistically significant. This indicates that an improvement of governance quality could contribute to reduce environmental degradation. Similarly, the results reveal that the interaction term of tourism and governance quality has a significant negative effect on CO_2 emissions. This implies that an improvement in governance quality could promote sustainable tourism and reduce environmental degradation.

5.2 | Practical and Managerial Implications

Regarding the practical and managerial ramifications, the governments of the countries included in the sample ought to endeavour to ensure that policies pertaining to tourism development are oriented towards the mitigation of greenhouse gas emissions. Tourism initiatives that aim to lessen their environmental impact should fall under this purview and be put into action. Furthermore, it makes sense to supplement the pertinent tourism development policies with additional good governance initiatives, as tourism development is neither a necessary nor a sufficient condition for the reduction of CO_2 emissions. Therefore, it is important to implement strong governance practices with tourism development strategies, with a focus on ensuring that governance dynamics reach certain essential levels. Therefore, governments that have been promoting sustainable tourism development without implementing strong good governance measures are misinterpreting the dynamics of the situation.

Considering the aforementioned, it is imperative that all three aspects of governance be strengthened, particularly with regard to: (i) enhancing the legitimacy and impartiality of political election processes so that political leaders are chosen and re-elected following a strong, democratic and competitive process (better political governance). (ii) Policies that support the development of environmentally inclusive tourism should be developed and made available to the general public, particularly to the portion of the populace that is less exposed to leisure travel (i.e., greater economic governance). (iii) In order to prevent the already wealthy and financially-included segment of the population from eventually taking advantage of environmental sustainability policies through tourism, it is worthwhile to create favourable conditions that enforce the citizens' and the state's respect of the institutions that govern interactions between the state and citizens (i.e., enhanced institutional governance).

TABLE 5 | Robustness check: Using the panel corrected standard errors (PCSE) estimation.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Gross domestic product per capita	2.955***	0.180	3.497***	3.985***	1.925***	3.427***	4.079***	4.029***	0.442	0.699	0.643	0.0731	0.585	0.353
	(0.536)	(0.536)	(0.811)	(0.914)	(0.226)	(0.693)	(0.999)	(0.943)	(0.579)	−(0.427)	−(0.433)	−(0.452)	−(0.359)	−(0.428)
Square of gross domestic product per capita	−0.142***	−0.0236	−0.173***	−0.200***	−0.0911***	−0.169***	−0.206***	−0.201***	−0.0383	0.0259	0.0225	−0.00875	0.0193	0.00559
	(0.029)	(0.029)	(0.043)	(0.049)	(0.012)	(0.036)	(0.053)	(0.050)	(0.031)	(0.023)	(0.023)	(0.024)	(0.020)	(0.023)
Industrialization	1.278***	0.760***	1.350***	1.413***	1.140***	1.352***	1.445***	1.428***	0.770***	0.859***	0.827***	0.700***	0.805***	0.755***
	(0.104)	(0.104)	(0.077)	(0.102)	(0.078)	(0.078)	(0.086)	(0.084)	(0.118)	(0.127)	(0.096)	(0.109)	(0.122)	(0.117)
Urbanization	2.178***	0.841***	2.294***	2.440***	1.817***	2.282***	2.468***	2.561***	0.749***	1.101***	1.321***	0.945***	1.146***	1.085***
	(0.114)	(0.114)	(0.221)	(0.258)	(0.085)	(0.191)	(0.278)	(0.297)	(0.129)	(0.141)	(0.079)	(0.104)	(0.116)	(0.120)
Trade openness	−0.660***	−0.466***	−0.715***	−0.808***	−0.961***	−0.736***	−0.855***	−0.776***	−0.439***	−0.598***	−0.747***	−0.476***	−0.597***	−0.539***
	(0.105)	(0.105)	(0.095)	(0.084)	(0.066)	(0.102)	(0.061)	(0.079)	(0.163)	(0.163)	(0.115)	(0.114)	(0.151)	(0.116)
Foreign direct investment	−0.00387***	−0.00290***	−0.00371**	−0.00418**	−0.00353**	−0.00329**	−0.00307*	−0.00304*	−0.00324***	−0.00234**	−0.00115*	−0.00208***	−0.00214***	−0.00212***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.107)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Energy consumption	1.115***	1.733***	1.330***	1.606***	2.248***	1.364***	1.634***	1.606***	1.574***	2.194***	2.392***	1.928***	2.138***	2.081***
	(0.095)	(0.095)	(0.139)	(0.206)	(0.151)	(0.139)	(0.180)	(0.195)	(0.000)	(0.227)	(0.159)	(0.117)	(0.202)	(0.139)
Tourism		0.840***							0.221*	0.256***	0.167***	0.182***	0.274***	0.263**
		(0.011)							(0.133)	(0.042)	(0.062)	(0.064)	(0.030)	(0.107)
Control of corruption			−0.167**						−1.233*					
			(0.083)						(0.042)					
Government effectiveness				−0.473***						−1.499**				
				(0.162)						(0.644)				
Political stability					−2.056***						−8.028***			
					(0.224)						(1.051)			

(Continues)

TABLE 5 | (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Regulatory quality						−0.372***						−5.029***		
						(0.143)						(0.817)		
Rule of law							−0.529***						−3.701***	
							(0.165)						(0.438)	
Voice & accountability								−0.811***						−5.574***
								(0.277)						(1.398)
Tourism × control of corruption									−0.499***					
									(0.073)					
Tourism × governance effectiveness										−0.665***				
										(0.038)				
Tourism × political stability											−0.424***			
											(0.056)			
Tourism × regulatory quality												−0.297***		
												(0.052)		
Tourism × rule of law													−0.405***	
													(0.027)	
Tourism × voice & accountability														−0.313***
														(0.091)
Constant	6.590***	−20.24***	6.872***	6.729***	−2.713***	6.689***	6.927***	6.800***	−21.31***	−19.11***	−14.24***	−14.88***	−16.22***	−14.65***
	(2.308)	(2.308)	(1.955)	(2.226)	(1.019)	(1.876)	(2.178)	(1.957)	(2.373)	(−2.101)	(2.293)	(2.682)	(1.982)	(3.251)
Observations	301	288	301	301	301	301	301	301	288	288	288	288	288	288
R-squared	0.751	0.751	0.193	0.205	0.418	0.195	0.212	0.202	0.752	0.762	0.802	0.758	0.763	0.758

Note: Standard errors in parentheses;
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Overall, the results of our study point to some important policy implications for lowering environmental footprint. In order to lower CO_2 emissions, policies that strengthen the quality of governance in the nations that were sampled could contribute to the consolidation of eco-friendly travel. The conclusions of this study have significant policy ramifications. First, as ecotourism appears to be crucial for environmental quality, officials ought to encourage foreign investors to increase their investments in it. Second, in order to slow down environmental deterioration, European authorities ought to promote the use of electric vehicles and motorcycles in the travel industry.

5.3 | Theoretical Implications

The results have theoretical ramifications in that they support the hypotheses presented in Section 2 by showing that the theoretical model that was employed to support the relationship between tourism and CO_2 emissions is not solely linear. The results of this study demonstrate that the theoretical models' ability to survive empirical scrutiny is dependent on certain other important policy or governance factors reaching some crucial levels. Consequently, the hypothesis that supports the positive correlation between tourism and CO_2 emissions are invalid above specific governance thresholds and valid below specific governance thresholds. Moreover, it is worthwhile to note that the theoretical implications of this study should be understood within the context of inductive research (i.e., for theory-building) as opposed to deductive research (i.e., for the confirmation and/or rejection of existing theories), not least because the inclusion of moderating governance variables in line with interactive regressions is a new strand of literature that is currently being developed and thus is worthwhile for theory-building in the relevant field.

5.4 | Limitations and Future Research Directions

The study's conclusions clearly leave room for more research, particularly when it comes to examining how established nexuses affect the accomplishment of other Sustainable Development Goals (SDGs) of the United Nations. The focus of these upcoming research directions should be one of the ways in which the associated nexuses are influenced by the principles of economic development unique to each nation. Furthermore, unless the results of additional research are subjected to empirical scrutiny and validity, it is not possible to extrapolate the findings to other regions.

As there is a huge difference in technology, governance quality and tourism development among developed and developing countries, future studies should examine the same subject in developing countries. Moreover, future studies should use other environmental degradation indicators to examine the same subject. These indicators include ecological footprint, greenhouse gases, natural resources and fluorocarbons gases.

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Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data for this study is available on request

Endnotes

[1]The countries include Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

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Appendix

TABLE A1 | Pesaran (2004) cross-sectional dependence test.

Variables	Statistics	*p* value
ENV	62.374***	0.00
GDP	37.952***	0.00
Trade openness	5.776***	0.00
FDI	8.318***	0.00
Urbanization	22.954***	0.00
Industrialization	15.065***	0.00
Energy	59.148***	0.00
Tourism	23.853***	0.00
Control of corruption	1.675**	0.00
Government effectiveness	3.314***	0.00
Political stability	1.888**	0.00
Regulatory quality	5.030***	0.00
Rule of law	3.780***	0.00
Voice & accountability	7.632***	0.00

Abbreviations: FDI, foreign direct investment; GDP, gross domestic product.
**p < 0.01. ***p < 0.001.

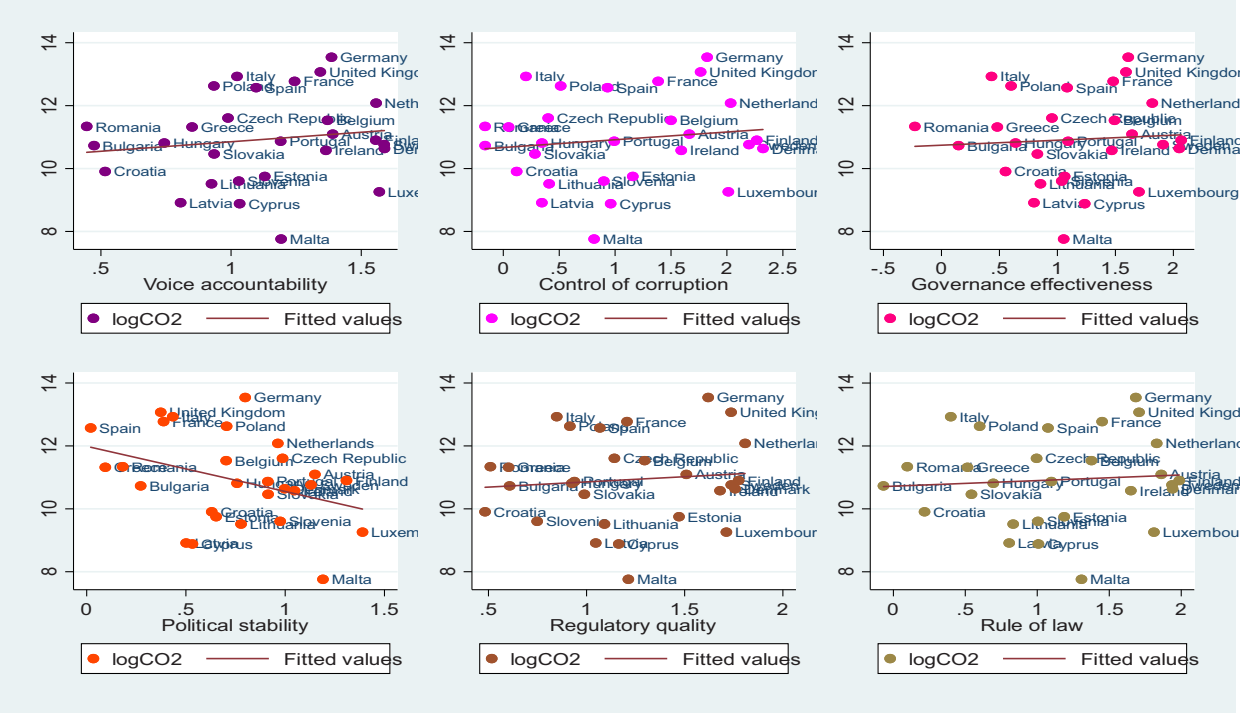

FIGURE A1 | CO_2 emissions–governance nexus in 28-EU countries, 2004–2019. Authors' computation based on data from World Governance Indicators (WGIs) and World Development Indicators (WDIs) of the World Bank. [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE A2 | Pesaran's cross-sectional augmented Dickey–Fuller.

Variables	Intercept *t* bar	Intercept and trend *t* bar
Level		
ENV	−4.186***	−2.892***
GDP	−11.733***	2.559
Trade openness	−7.719***	−1.925**
FDI	−11.123***	−6.610***
Urbanization	−9.571***	−1.998**
Industrialization	−6.435***	1.384
Energy	−4.542***	−6.005***
Tourism	−1.777***	2.491
Control of corruption	−7.297***	1.799
Government effectiveness	−9.568***	−3.117***
Political stability	−9.862***	−2.867***
Regulatory quality	−8.217***	1.292
Rule of law	−8.120***	−1.666*
Voice & accountability	−11.432***	−4.970***
First difference		
ENV	−14.900***	−11.769***
GDP	−13.161***	−9.175***
Trade openness	−15.727***	−11.214***
FDI	−18.655***	−18.716***
Urbanization	−3.192***	1.263***
Industrialization	−14.228***	−9.161***
Energy	−15.420***	−14.553***
Tourism	−13.920***	−9.973***
Control of corruption	−15.771***	−13.338***
Government effectiveness	−16.906***	−13.896***
Political stability	−16.766***	−13.605***
Regulatory quality	−15.303***	−10.750***
Rule of law	−16.764***	−14.303***
Voice & accountability	−16.609***	−14.169***

Abbreviations: FDI, foreign direct investment; GDP, gross domestic product.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

TABLE A3 | Results of panel cointegration tests.

	Statistic	*p* value
Augmented Dickey–Fuller *t*	3.2776***	0.0000

***p < 0.001.