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Do Islamic Values Matter for Environmental Protection? Empirical Evidence and Policy Suggestions Based on a Global Dataset

Betül Akgöl Can[1] I Zahoor Ahmed[2]

[1] Dr., Eskisehir Osmangazi University, Eskişehir /Türkiye
ORCID: 0000-0002-8427-6252
E-Mail: betul.can@ogu.edu.tr

[2] Prof., Dr., Adnan Kassar School of Business, Lebanese American University, Beirut 1102-2801, Lebanon, Department of Business Administration, Faculty of Economics, Administrative and Social Sciences, Bahçeşehir Cyprus University. Nicosia / Türkiye
ORCID: 0000-0001-9366-0582
E-Mail: zahoorahmed83@yahoo.com

Corresponding Author:
Betül Akgöl Can

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Abstract

Environmental degradation increases all over the world with every passing day. Scholars have attempted to understand the parameters that impact environmental quality over the last three decades. The empirical models use different economic and technological parameters as explanatory variables to do so. However, in recent times, some studies mentioned the importance of social parameters in reducing environmental degradation. Religious principles and values are among the main social parameters that may impact the environment. Considering that climate change's repercussions are increasing daily, understanding the relationship between religion and the environment is essential for effective climate control measures and policies. Although environmental studies based on theological issues are common, there is hardly any empirical investigation related to eco-theological arguments with macro data. This study is the first initiative to uncover the environmental quality and religious teaching and values nexus by applying various panel econometric approaches at the global level. Accordingly, this study inspected the impact of Islamic Principles on the environment in 147 countries. The novel findings provided evidence that Islamic values help decrease CO2 emissions in 147 nations. These findings offer more effective practices and solutions to environmental problems.

Keywords: *Environmental Sociology; Sociology of Religion; Islamicity Index; Environmental Degradation; Religious Values; Climate Change*

Öz

Çevresel bozulmalar tüm dünyada her geçen gün artmaktadır. Araştırmacılar son otuz yılda çevresel kaliteyi etkileyen parametreleri belirlemeye çalışmışlardır. Bu amaçla, ampirik modellerde açıklayıcı değişkenler olarak farklı ekonomik ve teknolojik parametreler kullanılmıştır. Ancak son zamanlarda, bazı çalışmalar çevresel bozulmayı azaltmak için sosyal parametrelerin öneminden bahsetmektedir. Bir toplumun ve o toplumun kültürünün en önemli unsurlarından olan dini değerler, çevreyi etkileyebilecek başlıca sosyal parametreler arasında yer almaktadır. İklim değişikliğinin yansımalarının her geçen gün arttığı düşünüldüğünde, din ve çevre arasındaki ilişkiyi anlamak, etkili iklim koruma önlemleri ve politikaları için elzemdir. Her ne kadar literatürde çevresel teoloji çalışmaları yaygın olsa bile, eko-teolojik argümanlarla ilgili makro verilerle yapılan ampirik araştırmalar yok denecek kadar azdır. Bu çalışma, küresel düzeyde çeşitli panel veri ekonometrik yaklaşımları uygulayarak çevre kalitesi ile dini prensip ve değerler arasındaki bağı ortaya çıkaran ilk girişimdir. Buna göre, bu çalışma 147 ülkede İslami ilkelerin çevre üzerindeki etkisini incelemiştir. Elde edilen bulgular, İslami değerlerin 147 ülkeden oluşan panelde karbon emisyonlarını azaltmaya yardımcı olduğuna dair kanıtlar sağlamıştır. Araştırmanın sonucunda söz konusu bulgular perspektifinde, çevre sorunlarına yönelik politika önerileri ve çözümleri sunulmuştur.

Anahtar Kelimeler: *Çevre Sosyolojisi; Din Sosyolojisi; İslamilik Endeksi; Çevresel Bozulma; Dini Değerler; İklim Değişikliği.*

Introduction

Environmental deterioration is among the most modern-day problems (Apergis et al., 2018). Fossil-based energy usage, energy production and distribution, agricultural production, and other economic activities are significant sources of environmental deterioration (Can et al., 2022). Environmental degradation threatens human health and causes different health problems (e.g., respiratory and cardiac diseases, premature deaths). Furthermore, climate change, which emerges from increasing greenhouse gases, leads to heavy storms, rising sea levels, and acid rains (IPCC, 2018; Sun et al., 2016). To eliminate these challenges, a lot of reports and initiatives have been released by numerous organizations (Ali et al., 2022).

Scholars make considerable efforts to determine factors that trigger environmental degradation. These factors can be categorized as social, technological, and economic factors (Can & Gozgor, 2017). Studies in the environmental literature have primarily discussed the source of environmental degradation in the context of economic and technological parameters, such as financial development, international trade, tourism, population, and economic complexity (e.g. Ang, 2009; Cerdeira Bento & Moutinho, 2016; de Vita et al., 2015; Gozgor & Can, 2016; Hu et al., 2020; Ren et al., 2019).

As social parameters have a crucial impact on human behavior (Foxon et al., 2013), some current studies specify that social parameters might play an essential role in influencing environmental degradation (Mrabet et al., 2021). Human behaviors, attitudes, and consumption practices play an important role in environmental problems because of people's interaction with the environment. Focusing only on technical issues limits understanding the problems and producing permanent solutions to them (Capelli-Schellpfeffer, 2012). In this context, the source of the environmental problem lies in the relationship that people establish with the planet (Ezzy, 2004). The things that determine human behavior in this relationship are the cultural understandings, values, beliefs, and mentalities of the societies they live in. In evaluating situations, people apply values. Values guide people's behaviors and attitudes (Adler, 1956; Kluckhohn, 2013; Schwartz & Bilsky, 1987). Therefore, they are important variables in defining social attitudes and behaviors (Rokeach, 1973). Values are created by some social actors. Culture and religion are some of these valuable creators in human society.

Contrary to what secularization theories argue (Wilson, 2016; Dixon, 1968; Bruce, 2002) religion continues to create very strong cultural influences in the modern period (Stark & Bainbridge, 1996; Beckford, 1990). Some parts of the world will be very religious while other parts will become increasingly secular meaning religious diversity will be polarized in the years to come (Stonawski et al., 2015). Currently, according to Hackett et al., (2017), 80 percent of the global population is part of a religious tradition. Compared to other social actors, religion, as a social actor, exerts greater influence in societies in terms of its ability to create meaning and value, establish moral authority, provide substantial material resources, and shape societies (Gardner, 2010). Religions affect their followers' worldviews and moral stances that can have institutional and economic power, and they ensure the achievement of collective goals due to their social connectivity (Haluza-DeLay, 2014).

Religions and religious values are among these social parameters that affect human and social behavior, which have a greater influence on environmental issues. Religions' teachings and their worldviews determine their followers' lifestyles and their relationships with the environment (Jenkins, 2009). Environmental deterioration is considered a social problem, which is one of the main issues that religion can influence. It is partly because, in religious teachings, some warnings have been made for the protection of the environment. It has been argued by many scholars that all religions offering a worldview have teachings that will impact the interaction of people and societies with the environment (Taylor, 2008; Gottlieb, 2006).[1] This effect does not mean that they

[1]The Encyclopedia of Religion and Nature includes key summary parts on the major traditions such as Christianity, Islam, Jewish, Buddhism, Hinduism, Confucianism, Taoism, Jainism, Sikhism, Yoga, Shinto, and others (Taylor, 2008).The Oxford Handbook of Religion and Ecology provides longer articles on Islam, Christianity, Jewish, Jainism, Hinduism, Buddhism, Daoism, and Confucianism (R. S. Gottlieb, 2006).

have a consensus on environmental problems. Many religions differ in how their followers will relate to nature as they offer a perspective on how to approach them related to biodiversity, ecosystems, ecological processes, and other environmental issues (Sponsel, 2010). However, they certainly offer a worldview toward environmental problems (Berry & Berry, 2009).

In this context, our principal goal is to investigate the effect of Islamic principles and values on the environment in a sample of one hundred and forty seven countries. The country constraint is based upon the accessibility of the data. This study seeks to contribute to current environmental economics literature in several ways. Initially, this is the first comprehensive research that explores the effect of Islamic principles and values (Islamicity Index) on the environment based on macro data. Second, the research simultaneously examines the impact of income and energy consumption on the environment. Third, we use various econometric techniques, such as the Durbin-H panel cointegration technique of Westerlund (2008), and the Common Correlated Effects-Mean Group (CCE-MG).

On the other hand, this study has several limitations. The first important issue was the publication of the Islamicity Index every five years which resulted in a reduction in total observations. In addition, data on some explanatory variables used in the empirical analysis was not available for all countries. Due to these issues, only one hundred and forty-seven countries were included in the study, and others were excluded due to data unavailability. In addition, the studies in the literature are mainly theoretical or survey-based, and no existing studies use macro data. Therefore, this study is very limited in terms of its literature.

The remaining part of this paper is structured as follows. Section two and three introduce theoretical background and data, empirical model, and econometric methods, respectively. While section four discusses results, section five offers policy recommendations. Section six provides conclusion, respectively.

Theoretical Background

Religions have the potential to play asignificant role in environmental degradation. Religions are very diverse; therefore, when examining the relationship between religion and environment, the discourses of world religions about the environment will also differ, and it will not be possible to gather them under a single category. In studies on the relationship between environment and religion, which are mostly based on Judeo-Christian traditions and societies, there is no consensus on whether religion/religious values affect environmental degradation positively or negatively, or whether there is a meaningful relationship between religion and environment. Research on the relationship between environment and religion gained momentum, especially after White Jr (1967) thesis. Researching the impact of Judeo-Christian values on the environment, White Jr (1967) pointed out that the source of the destruction of ecosystems is the anthropocentric worldview and domination-centered understanding of religion. In some later sociological and anthropological studies until the 1990s, in terms of Judeo-Christian values, it was argued that religion/religious values had a positive effect in some studies (Arbuckle & Konisky, 2015). The currently available studies show that the relationship between religion and environmental attitudes is not clear (Arbuckle & Konisky, 2015). For religiosity, the results are mixed, for example, people in some religions express a great deal of environmental concern (e.g., Hayes & Marangudakis, 2000), although some studies show that this concern is quite low (Wolkomir et al., 1997). For example, although there are denominational differences in Judeo-Christian traditions (Hand & Van Liere, 1984), some studies have found positive relationships between religiosity and environmentalism (Kanagy & Willits, 1993). While others are confirming White's thesis (Eckberg & Blocker, 1989; Boyd, 1999) stating that environmental issues are negatively affected (Schultz et al., 2000) by an anthropocentric perspective (Schultz et al., 2000; Eckberg & Blocker, 1989) and apocalyptic belief (Barker & Bearce, 2013) in Judeo-Christian traditions. Others have said that there is no meaningful relationship

between religion and the environment other than fundamentalist views (Woodrum & Hoban, 1994). Regardless of the religion, environmental attitudes vary even within the same religion. Conservative and fundamentalist attitudes and beliefs in religion, regardless of which religion people belong to and the relationship between these beliefs, show that they negatively affect the view of environmentalism (Woodrum & Hoban, 1994; Guth et al., 1995; Eckberg & Blocker, 1989; Boyd, 1999; Hayes & Marangudakis, 2000). More liberal attitudes in religions/religious values affect environmentalism positively. Catholics have less pro-environmental attitudes than Protestants (Whitford & Wong, 2009) and Protestants have less pro-environmental attitudes than non-Christians (Hayes & Marangudakis, 2000). Even in the same denomination, some Liberal Protestants are reported to have a greater environmental concern when compared with other Protestants (Hand & Van Liere, 1984; Hayes & Marangudakis, 2000). Moreover, conservative Protestants are reported to have a lesser environmental concern when compared with other Protestants (Eckberg & Blocker, 1989;Sherkat & Ellison, 2007). As the conservatism in religious values increases, environmentalism decreases compared to those who are moderately religious or do not define themselves as Christians (Clements et al., 2014).

Islam is among the world's largest religions in terms of the number of its followers in the world. According to Stonawski et al., (2015), it is expected that by 2060, it will be the largest religion in the world, because of high fertility rates and the young population. Therefore, it will be among the most significant actors in the world in terms of influencing people and their worldviews in the future. Islamic geography is mostly exposed to environmental problems (Koehrsen, 2021), and it is likely to remain in the future. The issue urgently needed to take the attention of scholars; so more empirical studies are needed.

Analyzing the relationship between the environmental issues and religion in Muslim countries is gaining great importance in environment literature. Islamic environmentalism literature emerged after the 1960s with the work of Seyyed Hossein Nasr (Hope & Young, 1994). Later, Islamic environmentalism was further developed with the studies of Dien & 'Izz al-Dīn (2000) and Khalid (2002, 2005). Islamic environmentalism and ethics are based on the Qur'an and Sunnah (Hancock, 2017). Although there are many studies on environmental ethics in Islamic teachings (Dien & 'Izz al-Dīn, 2000; Foltz, 2003), this interest is quite low in the empirical field.

There are small-scale sociological studies on the relationship between religion and the environment in the Islamic context. Existing small-scale studies have examined the effects of Islamic values on pro-environmental behaviors (Rice, 2006); the relationship between religiosity and environmental behaviors (Ayten & Hussain, 2017); religion and environmental consciousness (Emari et al., 2017); religiosity's effect on purchasing green products (Khan & Kirmani, 2018; Farooq & Yahya, 2021), and purchasing behaviors (Hassan, 2014); developing Eco-Islam in Arab markets (Abdelzaher & Abdelzaher, 2017); Islamic perspectives on green jobs (King & Shackleton, 2020). The large-scale report on the attitudes of Muslim religious leaders to the environment (Skirbekk & Pędziwiatr, 2018), organizations, and religious leaders' influence on climate change (Koehrsen, 2021), and gender-based environmental attitudes (Vasi, 2010) are also studied. Within the national Islam context, the environmental concern of Great Britain Muslims (Gilliat-Ray & Bryant, 2011) and the United States Muslims' environmentalism by Albrecht and Nimer (2011) are other important studies.

To understand what kind of worldview offers Islam to its followers about the environment, analyzing the main sources of Islam will be beneficial. These main sources are the verses of the Qur'an and the Hadith, which are the teachings and practices of the Prophet. There are approximately seven hundred verses on issues related to the environment in the Qur'an. Considering these verses, nature is God's gift to the creatures (Quran, 45/13; 16/65)[2], the world is created on a certain ecological balance (Quran,

[2] "He ˊalsoˋ subjected for you whatever is in the heavens and whatever is on the earth—all by His grace. Surely in this are signs for people who reflect (Quran, 45/13)." "And Allah sends down rain from the sky, giving life to the earth after its death. Surely in this is a sign for those who listen (Quran, 16/65)."

32/5; 55 / 7-9; 67/3; 25/2)[3], and man should protect animals. There are verses (Quran, 6/38) that the natural resources ought to be protected. They need to be used in moderation and they should not be wasted (Quran, 7/31; 17/27; 6/141)[4], attention is drawn to the fact that humans ought to preserve this balance while benefiting from nature (Quran, 25/67)[5]. Those who disrupt this balance are described as "mufsid / defeatist" (Quran, 2/205)[6] and various warnings are made against them (Quran, 30/41; 42/30)[7]. Besides these, emphasis is placed on cleanliness in areas where human beings exist, by constantly drawing attention to individual hygiene (Quran, 74/1-5)[8].

The prophetic discourses emphasize the environmental awareness of Muslims on both individual and social levels. For example, looking at these Hadiths, it is stated that nature is the mother of humans and they should protect it.[9] The Hadith also draws attention to afforestation[10] and trees. According to some Hadiths, the plants should be protected.[11]

Islam contains many different principles and values which set certain rules for its followers on how to live in harmony with people, society, and nature in the world. These values are combined in an index which is called the "Islamicity Index" developed by (Rehman & Askari (2010a; 2010b). The main goal of this index is to measure the degree of "Islamicity" of different countries in terms of experiencing Islamic values.[12] Experiencing these values means living and practicing these values both individually and collectively. These principles are determined according to the Qur'anic verses and the Hadith. In other words, the Islamicity Index is trying to measure 'the reflection and manifestation of these teachings in a community or a country'(Askari, 2019). The teachings are the determinant of the set of variables used as proxies. Islamicity Index comprises four sub-indices. These are Economic Islamicity Index, Legal and Governance Islamicity Index, Human and Political Rights Islamicity Index, and International Relations Islamicity Index. The sum of these indices makes up the Overall Islamicity Index.

The Islamicity Index does not focus on how Muslim countries are, but on how much Islamic principles and values are experienced in any country. Although countries belong to different faiths and religions, the fact that the values of Islam are experienced in these non-Islamic countries causes the Islamicity Index value of the relevant country to be high. For example, according to the recently published 2019 Islamicity Index, the top ten countries with the highest index value are New Zealand (9.07), Sweden (9.03), Iceland (9.02), Netherland (9.00), Switzerland (8.87), Denmark (8.85), Ireland (8.80), Norway (8.76), Luxembourg (8.74), and Australia (8.67). In the context of Muslim countries, the United Arab Emirates, Malaysia, and Albania, with the ranking of 44th, 45th, 46th and index values of 7.79, 7.17, and 5.73, respectively have a better position compared to all

[3] "He conducts every affair from the heavens to the earth, then it all ascends to Him on a Day whose length is a thousand years by your counting (Quran, 32/5)." "As for the sky, He raised it ˹high˺, and set the balance ˹of justice˺. so that you do not defraud the scales. Weigh with justice, and do not give short measure (Quran, 55/7-9)."˝He is the One˺ Who created seven heavens, one above the other. You will never see any imperfection in the creation of the Most Compassionate. So look again: do you see any flaws?(Quran, 67/3)." "….He has created everything, ordaining it precisely (Quran, 25/2)."

[4] "O Children of Adam! Dress properly whenever you are at worship. Eat and drink, but do not waste. Surely He does not like the wasteful (Quran, 7/31)." "Surely the wasteful are ˹like˺ brothers to the devils. And the Devil is ver ungrateful to his Lord (Quran, 17/27)." "He is the One Who produces gardens—both cultivated and wild[1]—and palm trees, crops of different flavours, olives, and pomegranates—similar ˹in shape˺, but dissimilar ˹in taste˺. Eat of the fruit they bear and pay the dues at harvest, but do not waste. Surely He does not like the wasteful (Quran, 6/141)."

[5] "˝They are˺ those who spend neither wastefully nor stingily, but moderately in between (Quran, 25/67)."

[6] "And when they leave ˹you˺,[1] they strive throughout the land to spread mischief in it and destroy crops and cattle. Allah does not like mischief (Quran, 2/205)."

[7] "Corruption has spread on land and sea as a result of what people's hands have done, so that Allah may cause them to taste ˹the consequences of˺ some of their deeds and perhaps they might return ˹to the Right Path˺(Quran, 30/41)." "Whatever affliction be falls you is because of what your own hands have committed. And He pardons much (Quran, 42:30)."

[8] "O you covered up ˹in your clothes˺!. Arise and warn ˹all˺..Revere your Lord ˹alone˺.Purify your garments..˹Continue to˺ shun idols (Quran, 74/1-5)."

[9] "And take care of the earth for verily she is your mother (Sharma, 2021: 50, Tabaran)."

[10] "Whoever plants a tree and diligently looks after it, until itmatures and bears fruit, is rewarded(Ibn Hanbal & Abd Allah ashShaybani, 1992: 415)." "If a Moslem plants a tree or sows a field and men and beasts and birds eat from it, all of it is charity on his part,' and again, 'the world is green and beautiful and God has appointed you his stewards over it (Negi, 2005)."

[11] "He who cuts a lote-tree [without justification], Allah will send him to Hellfire (Ashtankar, 2016; Anjum & Wani, 2018)"

[12] The index comprises four sub-indices related to economics, legal and governance, human and political rights, and international relations. Each of these titles has subtitles. Please see for details (Askari & Mohammadkhan, 2017).

other Muslim countries. The fact that non-Muslim but industrialised countries rank higher on these indices compared to Muslim countries raises questions about the validity of these indices (Bowe and Makki, 2016).

Islamicity index differs from the Maqasid Shari'ah-based indices in that it is based on the values derived from the primary sources of Islam, namely the Qur'an and Sunnah, and is also criticised for not being based on the Maqasid Shari'ah. Islamicity Index is criticised for its inability to measure the impact of such social activities in Muslim societies, especially since social rituals such as zakat, congregational prayer and pilgrimage, which unite Muslims, cannot be measured in a quantitative context. At the same time, the fact that charity is not measured in Muslim societies because it is voluntary and therefore unrecorded, on the other hand, the fact that it is realised through the state in non-Muslim welfare societies causes these rates to be high for equal and fair sharing of income. It has been criticised that some Islamic values can be measured through more qualitative in-depth observations rather than quantitative ones (Sencal, 2021).

Data, empirical model, and econometric methodology

Data and empirical model

In this research, our primary objective is to inspect the result of the Islamicity Index on CO_2 emissions in a case study for one hundred and forty seven countries. We employ yearly data consisting of 2000, 2005, 2010, 2015, and 2016 because of the availability of the data for the Islamicity Index. We try to keep as many countries as possible, to get sufficient data for all dependent and independent variables. Our empirical model is based upon the work of Arouri et al. (2012), Can et al. (2021), and Narayan & Narayan (2010). According to these scholars, income and energy use are the primary drivers of environmental deterioration. Our main model is described as follows:

$$CO2PC_{i,t} = f\left(GDPPC_{i,t}^{\beta_1}, EPC_{i,t}^{\beta_2}, IS_{i,t}^{\beta_3}\right) + e_{i,t} \quad (1)$$

$$CO2PC_{i,t} = \beta_0 + \beta_1 GDPPC_{i,t} + \beta_2 EPC_{i,t} + \beta_3 IS_{i,t} + e_{i,t} \quad (2)$$

Where i and t stands for country and time, independently. Besides in the model CO2PC, GDPPC, EPC, and IS indicate CO_2 emissions per capita, per capita income, energy consumption per capita, and Islamicity Index, respectively. According to previous literature, we expect GDPPC and EPC to increase CO_2 emissions, while IS has the potential to decrease CO_2 emissions because when following of Islamic principles increases, it is expected that the environmental degradation might lessen. The error term is represented by $e_{i,t}$. The datasets for CO_2 emissions (metric tons per capita), GDP per capita (constant 2010 US$), and EPC (kg of oil equivalent per capita) were acquired from the World Development Indicators (WDI), Islamicity index was obtained from Islamicity Foundation. Unlike the previous literature that mainly consists of survey-based studies, this study uses macro-level data, which was separately collected for every single country. Thus, this research does not provide participant demographic characteristics.

Table 1: Data and variables

Variables	Symbol	Measurement	Data Source
CO2 emissions	CO2PC	CO_2 emissions (metric tons per capita)	World Development Indicators (WDI)
Income	GDPPC	Index GDP per capita (constant 2010 US$)	World Development Indicators (WDI)
Energy Consumption	LEC	Energy consumption per capita (kg of oil equivalent per capita)	World Development Indicators (WDI)
Islamic Principles	IS	Index	Islamic Foundation

Note: The list of countries is provided in Appendix 1.

Econometric methodology

In this research, we use different panel econometric estimation approaches and our estimation consists of five different steps.

Cross-sectional dependence

In the initial step of empirical examination, we verify whether the series has cross-sectional dependence or independence. In the modern world, an event in a country can easily impact other nations. Thus, it is an important process to check CD. Disregarding CD in panel data results in biased results because many unit-root, cointegration, and long-run estimation tests do not take into account CD. To fulfill this objective, we utilized the CD test developed by Pesaran (2021). Pesaran's (2021) CD test can provide consistent results under the assumption of T> N or N > T. The Pesaran CD test statistics are displayed as follows:

$$LM_{adj} = \left(\frac{2}{N(N-1)}\right)^{1/2} \sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \hat{\rho}_{ij}^{2} \frac{(T-K-1)\hat{\rho}_{ij}-\hat{\mu}_{Tij}}{\upsilon_{Tij}} \sim N(0,1) \quad (1)$$

where $\hat{\mu}_{Tij}$ represents mean and υ_{Tij} indicates variance.

Slope homogeneity test

Next, we utilized Pesaran and Yamagata's(2008) slope homogeneity test which is commonly used to disclose whether the slope coefficient is homogeneous in the cointegration equation. This is another important step for the selection of appropriate unit root, cointegration, and long-run estimation. Because some estimation techniques are not based on heterogeneous slope assumptions. The Pesaran and Yamagata (2008) homogeneity test statistics are displayed as follows:

$$S = \sum_{i=1}^{N} (\beta_i - \beta_{WFE})' \frac{x_i' M_\tau x_i}{\sigma_i^2} (\beta_i - \beta_{WFE}) \quad (2)$$

$$\Delta = (N)^{1/2}(2k)^{1/2}\left(\frac{1}{N}S - k\right) \quad (3)$$

In this equation, *S* indicates the test statistics. β_i stands for the coefficient of pooled ordinary least square (OLS) and weighted fixed effect pooled estimator.

Unit root analysis

Then we use the Hadri and Kuruzomi (2012) unit root test which is a second-generation unit root test that takes into consideration the cross-sectional dependency and permits the presence of common factors. In this stage, the null hypothesis of 'no unit root in the series' is verified against the alternative hypothesis of 'unit root in the series'. This is a vital step for using appropriate cointegration and long-run analysis. In addition, it corrects the autocorrelation problem in the process.

Cointegration test

In panel studies, before long-run estimation, it is generally considered necessary to check the long-run link between a dependent variable and explanatory variables. For cointegration analysis, the Durbin-H panel cointegration strategy is used which was presented by Westerlund (2008). This estimation is a popular technique and extensively used in recent literature because it takes into account common factors and CD. This approach can be adopted when the explanatory variable is I(0) or I(1)and the dependent variable is I(1). Westerlund's (2008) cointegration approach gives DH_group statistics and the DH_Panel tests statistics based on the Durbin-Hausman principle.

Long-run estimation

In the last step, the Common Correlated Effects-Mean Group (CCE-MG) approach of Pesaran (2006) is applied to inspect the long-run coefficient of the independent variables. This approach assumes that independent variables and unobservable common effects are static and external. Apart from this, it is also consistent when independent variables and unobservable common effects are stationary (I (0)), first-order integrated (I (1)), and/or cointegrated.

Empirical findings

It is essential to apprehend whether the variables are cross-sectionally dependent or independent since the proper unit root and cointegration analysis can be chosen according to the outcomes

of the CD test. Hence, we utilize Breusch and Pagan (1980)(CDLM1) and Pesaran (2021) CD tests (CDLM2 and CDLM3) on the series and cointegration equations for one hundred and forty seven countries. The findings exist in **Table 1**. The results indicate that the null hypothesis of cross-sectional independence is firmly rejected at the 1% significance level.

Table 1: *Testing the cross-section dependency of the variables and models*

	CD-test					
Variable	CDLM1-test	p-value	CDLM2-Test	p-value	CDLM3-Test	p-value
						Level
CO2PC	18001.63	0.000***	211.0482	0.000	206.9926	0.000***
GDPPC	17143.76	0.000***	199.2153	0.000	195.1597	0.000***
EPC	17058.03	0.000***	198.0327	0.000	193.9772	0.000***
IS	15721.07	0.000***	179.5915	0.000	175.5359	0.000***
Equation	12132.47	0.000***	176.5125	0.000	104.2654	0.000***

Notes: *** indicates the rejection of the null hypothesis at the 1% significance level.

In the second step, we run Hadri and Kurozumi's(2012) unit root test to analyze the null hypothesis of 'no unit root in the series'. The results are reported in **Table 2**. According to these findings, the null hypothesis is rejected and we confirmed that all the series are not stationary at the level while they end up being stationary at the first differences at a 1 percent significance level.

Table 2: *Testing the order of integration of the variables*

Hadri and Kuruzomi (2012) test for Countries								
Variable	Level		Critical Value		First Difference			
	Z_A^{SPC} Stat.	Prob.	Z_A^{LA} Stat.	Prob.	Z_A^{SPC} Stat.	Prob.	Z_A^{LA} Stat.	Prob.
CO2PC	12.0206	0.0000	10.8133	0.0000	-1.7135	0.9567***	-0.5736	0.7169***
GDPPC	12.3116	0.0000	11.1579	0.0000	-1.0104	0.8438***	-0.2700	0.6064***
EPC	12.4540	0.0000	10.5391	0.0000	-1.4518	0.9267***	-0.7154	0.7628***
IS	12.3557	0.0000	11.2407	0.0000	-1.2931	0.9020***	-0.2113	0.5837***

Notes: *** indicates the rejection of the null hypothesis at the 1% significance level.

Before running the cointegration test, we take a look at whether the slope coefficient is homogeneous or not using a Pesaran and Yamagata (2008) test. The results are presented in **Table 3**. The empirical findings validate the rejection of the null hypothesis of slope homogeneity at a 1 percent significance level. To put it simply, the cointegration equation states that the constant term and slope coefficients are homogeneous. In this case, the cointegration comments for the overall panel are valid.

Table 3: *Homogeneity test*

Variable	Test-stat	p-value
$\tilde{\Delta}$	-0.609	0.729***
$\hat{\Delta}_{adj}$	-1.492	0.932***

Notes: *** incidates the rejection of the null hypothesis at the 1% significance level.

In literature, the cointegration technique is extensively employed to explore the long-run estimation Pedroni. Thus, in the next step, we run the Durbin-H cointegration approach presented by Westerlund (2008) to test the long-run link between the dependent and independent variables. The empirical results which accept the rejection of the null hypothesis of "no cointegration between the series" are provided in **Table 4**. According to this evidence, we decide that there is a long-run link among the series in the long run.

Table 4: *Durbin-H panel cointegration test*

Variable	Test-stat	p-value
Durbin-H Group stat	74.849	0.000***
Durbin-H Panel stat	2.997	0.001***

Notes: *** indicates the rejection of the null hypothesis at the 1% significance level.

Finally, we utilize the CCE-MG estimator developed by Peseran (2006) to discover the impact of Islam Principles (Islamicity Index) and other

explanatory variables on the environment. The findings are reported in **Table 5**. The outcomes provide that while energy use (ENPC) is a crucial driver for environmental deterioration, income (GDPPC) and Islamic Principles (IS) have a suppressing impact on CO_2 emissions. According to empirical findings, when the energy use increases by 1 percent, the CO_2 emissions will rise 0.02% in the sample. Remarkably, the acquired outcomes expose that coefficient for income per capita (GDPPC) is negative and significant at a 10 percent significance level. According to this result, we can analyze that if GDPPC increases by 1 percent, the CO_2 emissions lowers by around 71 percent in the sample countries. Furthermore, the findings reveal that Islamicity (Islamic Principles) plays an essential function in reducing environmental deterioration. When Islamicity Index is boosted by 1 percent, the environmental degradation will lessen by approximately 27 percent. This outcome is the unique contribution of our research related to environmental economics.

Table 5: *Long-run panel cointegration coefficients*

Model : CO2PC=F(GDPPC, EPC, IS)		
Variable	Coefficient	t-stat
GDPPC	-0.7169	-1.41*
EPC	0.0002	5.20***
IS	-0.2767	-1.74**

Notes*: ***, ** & * indicates significance levels at the 1%, 5% and 10%, respectively. While calculating the t statistic, Newey-West heteroscedasticity standard error was used. Panel cointegration coefficients have been estimated by the Common Correlated Effects Mean Group (CCE-MG) method of Pesaran (2006) considering the cross-sectional dependency.*

Policy recommendations

The environmental problems impose a threat for all humanity. As values are guiding principles that enable people to interpret the world (Schwartz, 1999), all kinds of cultural, religious, and religious values should be used to overcome and manage this problem and create a more eco-social environment in the world (Kearns & Keller, 2009). Religion has the potential to support or discourage actions for protecting the environment (Tarakeshwar et al., 2001). As said before, recent studies based on eco-theological context show that religion can play a positive role in environmental sustainability (Haught, 1996). Although some religions, such as Islam, Daoism, Hinduism, and Buddhism (Jenkins et al., 2017) or some new religious and ingenious and spiritual movements (Chapple, 2011) seem to be in harmony with the environment in terms of values and discourse, it turns out that this is not the case in practice in terms of environmental outputs. The problem here is that, rather than what religion and religious values say, the necessary environmental policies cannot be produced, and measures cannot be taken in societies where religion/religious values are dominant. At this point, although religions produce a discourse about the environment, policymakers and the economic conditions of societies affect environmental policies. In this context, policy makers' use of religion and religious values as a tool to increase eco-social environments will facilitate their work.

The findings gained from CCE-MG reveal that Islamic values have a suppressing impact on environmental degradation. In this context, we can divide policy implications into two parts. The first policy recommendation part is for the countries consisting of the full sample. In this sample group, there are different countries where Christianity, Islam, Jewish, Buddhism, Hinduism, and Confucianism are official state religions or nonreligiousness is a dominant attitude. In these countries, high values of the Islamicity index will pose a positive impact on increasing environmental quality. To increase Islamicity index values, governments should support economic freedom and property rights. Policymakers ought to support new investments (both foreign and domestic) to create new job opportunities, which also contribute to reducing income inequality and increasing human development in the country. Increasing educational quality is another important parameter that may impact the environment. For this purpose, governments should make a long-run plan for education. With the increase in education, countries can manufacture more complex and knowledge-based products which are less harmful for the environment.

The second policy recommendation is about Islamic countries. The Islamicity index shows that

Islamic values in some non-Islamic countries are higher than in Islamic countries which means Islamic values and principles are not fully practiced in OIC countries. The reason for this may stem from the understanding of religion and worldview. As mentioned in the second section, many expressions support the ecological understanding in Islamic verses and the hadiths. Based on these Islamic values environmental behaviors can be fostered and the formation of Islamic environmental ethics will be possible (Rice, 2006). However, although Islam supports environmentalist behaviors in terms of intellectual, sacred, and philosophical teaching (Dien & 'Izz al-Dīn, 2000) and establishes its relationship with the world as stewardship (caliphate) rather than a dominion understanding, initiatives and politics for environmental activities have a low impact in terms of their contribution to sustainability in Muslim countries.

Chapple (2011) especially states that world religions are light green in terms of environmental problems, and the world needs a darker green religion in terms of spiritual, social, and worldview. Considering the sociological realities, why are not these light green attitudes in world religions turned into dark green ones, especially in Islam? When the future of Islam is taken into the account in the world, there need to be urgent initiatives carried out by Muslim societies to create more dark green attitudes in the environment of Islamic countries.

In the light of the above findings, it is very important to take various initiatives to make these values into practice in these Islamic countries. In places, where official institutions are not developed so much in terms of environmental protection; cultural, social, and religious values will be effective in adopting pro-environmental attitudes and behaviors (Zemo & Nigus, 2021). More specifically, the following religious implications will be beneficial to create both individual and collective environmental sensitivity which in turn contribute to increasing environmental quality. Some of the political implications suggested in terms of this paper are:

Integrating religion into environmental protection programs is a crucial point (Niamir-Fuller et al., 2016), the power of transformation in religions provides societies to become more sustainable (Bergmann, 2009; Gottlieb, 2008). The governments in Muslim countries should be part of environmental solutions urgently (Nasr, 2003).

Religious leaders have important roles in considering the close relations of religious leaders with politicians and other social decision-makers. Religious leaders can influence public opinion (Casanova, 2011; Davie, 2010) and in this context, they can raise awareness of environmental problems and influence political decision-making mechanisms to produce more environmentally friendly policies (Reder, 2012).

It is very important to bring the world-facing aspect of Islam to the fore among religious scholars and religious education since the afterlife and apocalyptic beliefs cause indifference to environmental problems in religions. As the environmental problem is a mindset problem, the understanding of fate, free will, apocalyptic beliefs, or victim consciousness makes people have a passive stance toward environmental problems. Accordingly, some religious and cultural educational programs should be carried out to make people feel that they have autonomy in their life and they can be decisive in their behaviors and lifestyles.

An ecological understanding of religion will enable people to understand that human beings are part of the ecology and not masters of ecology, and ecological stewardship must be developed as a mindset. Accordingly, religious people should have developed an awareness that they are a part of the ecology and they should live in harmony with nature. All these implications and suggestions are based on the idea that religion is a system that builds a mindset. Religion, which is the ultimate power of legitimation, will be important in instilling environmental awareness in both individual and collective dimensions. In the long turn, attaching a sacred meaning to environmental awareness might enable individuals, societies, and countries to develop more environmentally friendly lifestyles and policies.

Conclusion

A closer look at Muslim countries shows that autocratic forms of governance, limited individual

freedoms, inadequate provision of human rights, economic underdevelopment, economic and social injustice and radicalist Islamic discourses show that these countries are in great need of various reforms. In the 21st century, environmental crises have been added to these negative situations and Muslim countries have their share of this crisis.

Environmental deterioration is increasing day after day. To minimize the degradation, various institutions and organizations launch reports routinely. Additionally, scholars have sought to discover the indicators that impact environmental quality. In these researches, scholars typically utilize economic and technological parameters as explanatory variables in the empirical models. Although social parameters might have a prospective result on the environment, they are generally omitted from the models. Religion/Religious values are among the most essential parameters that shape the attitudes, behaviors, and mindset of society. To do that, in this research, we checked the impact of Islamic Principles (Islamicity Index) on environmental degradation in the sample of one hundred and forty seven countries. The findings provide evidence that when the index value increases, the environmental degradation reduces.

For future studies, we advise the scholars to explore the effects of Islamic values on the environment in Muslim countries. In terms of adopting and practicing Islamic values, the Islamicity index brings the theory and practice paradox to light. So the reasons for this paradox need to be scrutinized in further studies. Moreover, in this research, environmental degradation is represented by CO_2 emissions, for future studies, we advise using ecological footprint, air quality, or different environmental indicators.

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Appendix 1: List of countries

Albania	Algeria	Angola	Argentina	Armenia
Australia	Austria	Azerbaijan	Bahrain	Bangladesh
Belarus	Belgium	Belize	Benin	Bolivia
Bosnia and Herzegovina	Botswana	Brazil	Bulgaria	Burkina Faso
Burundi	Cambodia	Cameroon	Canada	Chad
Chile	China	Colombia	Congo, Dem. Rep.	Congo, Rep.
Costa Rica	Croatia	Cyprus	CzechRepublic	Denmark
DominicanRepublic	Ecuador	Egypt, ArabRep.	El Salvador	Estonia
Ethiopia	Finland	France	Gabon	Georgia
Germany	Ghana	Greece	Guatemala	Guinea
Guyana	Haiti	Honduras	Hong Kong	Hungary
Iceland	India	Indonesia	Iran, IslamicRep.	Iraq
Ireland	Israel	Italy	Jamaica	Japan
Jordan	Kazakhstan	Kenya	Korea, Rep.	Kuwait
Kyrgyz Republic	Lao PDR	Latvia	Lebanon	Lesotho
Liberia	Libya	Lithuania	Luxembourg	Macedonia
Madagascar	Malawi	Malaysia	Mali	Malta
Mauritania	Mauritius	Mexico	Moldova	Mongolia
Morocco	Mozambique	Namibia	Nepal	Netherlands
New Zealand	Nicaragua	Niger	Nigeria	Norway
Oman	Pakistan	Panama	Papua New Guinea	Paraguay
Peru	Philippines	Poland	Portugal	Qatar
Romania	Russian Federation	Rwanda	Saudi Arabia	Senegal
Serbia	Sierra Leone	Singapore	Slovak Republic	Slovenia
South Africa	Spain	Sri Lanka	Sudan	Suriname
Swaziland	Sweden	Switzerland	Tajikistan	Tanzania

Thailand	Togo	Tunisia	Turkey	Turkmenistan
Uganda	Ukraine	United Arab Emirates	United Kingdom	United States
Uruguay	Uzbekistan	Venezuela, RB	Vietnam	Yemen, Rep.
Zambia	Zimbabwe			

Note: Alphabetical order runs from left to right.

Statements & Declarations

1. **Ethics approval and consent to participate: Not applicable**
2. **Consent for publication: Not applicable**
3. **Availability of data and materials: All data generated or analysed during this study are included in this article.**
4. **Competing interests: The authors declare that they have no competing interests.**

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