Economica: Jurnal Ekomomi Islam
Vol 17, No 1 (2026): 153–179
DOI: 10.21580/economica.2026.17.1.29700

economica
Jurnal Ekonomi Islam

Heterogeneous Relationships Between Islamic Finance, Human Development, and Carbon Emissions: Evidence from OIC Countries

Danial Muhammad Wirdyansyah [1]*, Vaira Nur Zahra [1], Risti Ayu Utami [1], Ika Sri Wahyuni [2]

[1] Universitas Islam Negeri Sunan Gunung Djati Bandung, Bandung, Indonesia
[2] Rumah Wakaf Indonesia, Bandung, Indonesia

Abstract

This study investigates the impact of Islamic Investment and the Human Development Index (HDI) on carbon emissions in member countries of the Organization of Islamic Cooperation (OIC) from 2013 to 2023. Islamic Investment is measured by *ṣukūk* holdings and Sharia-compliant financing to the industrial sector. The impact of HDI on carbon emissions is tested as an indicator of the quality of human development. This study uses the Quantile Regression and the Fully Modified Ordinary Least Squares (FMOLS) methods to analyze the distributional and long-term relationships of the variables. The results show that *ṣukūk* holdings are negatively and significantly related to carbon emissions of member countries, especially those in the low- to medium emission level category. Sharia-compliant financing to the industrial sector is found to be positively and significantly related to carbon emissions, indicating an ineffectiveness in the shift to a green industry. HDI is shown to be negatively and significantly related to carbon emissions at the lower and middle quantiles. Long-run significant impacts of HDI are also shown. Overall, the results show the need for OIC member countries to focus on the use of sustainability-based Islamic financial instruments to help achieve their decarbonization goals and improve the quality of human development.

Keywords: Carbon Emissions; Human Development Index; Islamic Investment; OIC Countries; Quantile Regression

Citation (APA):
Wirdyansyah, D. M., Zahra, V. N., Utami, R. A., & Wahyuni, I. S. (2026). Heterogeneous Relationships Between Islamic Finance, Human Development, and Carbon Emissions: Evidence from OIC Countries. *Economica: Jurnal Ekonomi Islam*, *17*(1), 153–179. https://doi.org/10.21580/economica.2026.17.1.29700

Submitted: 29 Nov 2025
Revised: 29 Jan 2026
Accepted: 25 May 2026
Published: 30 May 2026

Copyright: © 2026 by Economica: Jurnal Ekomomi Islam

This is an open access article under the terms and conditions of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

*Corresponding Author. Email: danmuhammadw@gmail.com

Introduction

There are many records in 2024. Global CO_2 emissions broke all previous records, reaching 37.8 billion tons. The rise in the global temperature compared to the pre-industrial era reached 1.45°C. The International Energy Agency and the World Meteorological Organization released reports for 2025 about the status of climate change, confirming the alarming situation. The frequency of natural disasters has tripled in the last 20 years (Siregar et al., 2024). In 2023, it is reported that the total economic losses were $313 billion. The reports describe that, in the last two years, there has been a sharp increase in the number of phenomena such as forest fires, hurricanes, heat waves, and floods in the world (Herlambang, 2025; World Meteorological Organization, 2025). The impact of climate change is more severe in the developing countries. They are faced with the "emissions vs. economic growth" dilemma. Therefore, an international financing system to promote sustainable development is required (Behera & Dash, 2017; Sethi, 2023). The OIC member countries illustrate this situation the most, with some being high emitters (Qatar and UAE) and some being highly vulnerable countries (such as Bangladesh and Pakistan) (Al Hasyim, 2025). Among the 10 sample countries of this report, per capita CO_2 emissions for the 2013-2023 period were 46.89 tons in Qatar, 21.87 tons in the UAE, 0.88 tons in Pakistan, and 0.61 tons in Bangladesh (Statistical, 2025). Improving the quality of human capital in developing countries is crucial to meet the SDGs and gain a competitive advantage, and can be realized through value-based financing, including Islamic Finance (Dika et al., 2024).

At the same time, several OIC countries play key roles in the global Islamic finance ecosystem (Ardiansah, 2024). According to the ICD–LSEG Islamic Finance Development Report 2024, global Islamic financial assets reached USD 4.9 trillion in 2023 (ICD & LSEG, 2024). The report shows the rapid growth of *ṣukūk* and green *ṣukūk* since 2013 and their role in financing renewable energy, sustainable transport, and green infrastructure (Fahlevi & Wirdyaningsih, 2024; Qur'an & Akhmadi, 2025). This confluence of high emission pressure and an expanding Islamic financial sector raises the question of whether Islamic finance can channel capital toward less carbon-intensive development. Islamic finance theory helps to conceptualize the link. The principles of Islamic finance, i.e., the prohibition of *ribā*, *gharar*, and *maysir*, and the focus on asset-backed and risk-sharing transactions, tie financing to the real economy and to the social and environmental impacts of that economic activity (Hidayat, 2023; Nuraini, 2024). *Maqāṣid al-Sharīʿah* provides the normative objective: financing must facilitate the preservation of life and wealth

(*ḥifẓ al-nafs* and *ḥifẓ al-māl*) (Chapra, 2008) and has been argued to provide the basis for reconciling economic growth and social justice with environmental protection (Ameziane, 2024). Al-Qaradawi extends the interpretation of the preservation of life and wealth to the ecological dimension without adding a sixth objective. He argues the preservation of the environment (ḥifẓ al-bī'ah) is a necessary and sufficient condition (wasīlah) for attaining the five main objectives (Al-Qaradawi, 2001; Al Banna & Rosyidah, 2025; Saefullah, 2026).

Two important paths of interaction are identified here through which Islamic investment relates to environmental sustainability: the *ṣukūk* holdings of Islamic banks that channel capital through asset-backed financing, and Islamic financing of industry (ISIC sections C to F) that is most related to emission-intensive activities. Irfany, Syam, et al. (2024) report that a substantial part of financing by Sharia banks in OIC countries is directed towards industry, and call for the disaggregation of Islamic financing between the consumptive and productive sectors. Financial allocation, as mentioned above, is just one side of the story, and the quality of development will determine the actual impact of the financing on environmental outcomes. The Human Development Index (HDI), which captures progress made in health and education, and in raising people's standard of living, reflects this quality of development.

According to distributional impact theory, higher levels of economic inequality lead to the disproportionate impact of environmental degradation on the poorer segments of the population, and to higher levels of unsustainable exploitation of resources by the poor (Boyce, 1994; Kamalu & Ibrahim, 2023). Environmental inequality coincides with economic inequality in terms of who bears the costs of environmental degradation, who is informed about them, and how the poor and the rich evaluate the future costs (Boyce, 1994). In higher human development the awareness and acceptance of environmentally sustainable practices improve (Bahri & Aprilianti, 2023). The relationship between HDI and CO_2 emissions, however, is complex. For example, during the transition to high HDI, the convergence of human development and CO_2 emissions is assumed to be negative (Li et al., 2023). Using Quantile Regression for the G20 countries Ali et al. (2021) also showed that in some cases, HDI can have an impact in reducing emissions, thus suggesting a 'non-threshold' effect. Among the OIC countries, the UAE and Qatar, for example, have high levels of HDI, while most of the other OIC countries are at medium and low levels. In OIC research on income inequality, it has been shown that human development and Islamic finance can be mutually reinforcing (Kamalu & Ibrahim,

2023). It has not been analyzed whether they can be jointly affecting carbon emissions.

While some studies have shown that Islamic finance has the potential to support environmental sustainability, evidence on the effects of Islamic finance on CO_2 emissions in OIC countries is still fragmented. Most of the studies on the OIC countries have relied on mean-based or dynamic approaches, such as the Sys-GMM and FMOLS (Mu'min et al., 2024), PCSE and FGLS (Smolo, 2026), GLS-weighted FEM (Irfany, Syam, et al., 2024), and panel regression (Irfany, Utami, et al., 2024). These studies reported different effects of Islamic finance. The development of Islamic finance and the growth of Islamic financial assets are linked to a reduction in emissions, while the use of Islamic banking for financing may be linked to an increase in emissions if the financing supports carbon-intensive activities. The industry also shows that the environmental impact of Islamic financing is not the same for all industries (Farabi et al., 2025). However, most of the studies do not look at the effects of the distribution of CO_2 emissions.

While Uysal et al. (2026) and Miyan et al. (2026) use quantile-based methods in OIC contexts, their models are broader, covering aspects of the overall progress of Islamic financial development, including bank-held *ṣukūk*, Islamic industrial financing (ISIC C-F), and HDI jointly. On the other hand, Mu'min et al. (2024) employ FMOLS, not distributional effects by means of QREG, bank-held *ṣukūk*, and ISIC C-F and HDI jointly. Fodol et al. (2026); Fodol & Aslan (2026), on the other hand, look at bank-held *ṣukūk*, do not look at distributional effects, and do not estimate FMOLS long-run effects. Therefore, in the existing literature, a combination of the distributional effect of QREG and FMOLS long-run effects for bank-held *ṣukūk*, ISIC C-F, and HDI jointly has not been studied in relation to CO_2 emissions in OIC countries.

This study aims to address this research gap by jointly employing bank-held *ṣukūk*, ISIC C-F, and HDI, with QREG and FMOLS for a sample of OIC countries. QREG focuses on low-, medium-, and high-emissions countries, and FMOLS focuses on long-term effects. Thus, from the perspective of the OIC studies, this research ties the long-term effects of Islamic finance to the environmental emissions of OIC countries. The study conceptually combines Islamic finance and *maqāṣid al-Sharīʿah* to show how financial allocation may promote or hinder environmental sustainability. The distributional perspective is integrated to understand the differences in emission levels. The study provides more specific evidence by differentiating between bank *ṣukūk* and Islamic finance and focusing on industrial financing as opposed to treating

Islamic finance as a single aggregated finance. The expected outcomes of the study will provide a basis for targeted green Islamic finance policies for the OIC countries with varying levels of CO_2 emissions.

Literature Review

Islamic Finance Theory and *maqāṣid al-Sharīʿah*

Islamic Finance Theory highlights principles of shariah including justice, ethical conduct, risk sharing, and avoidance of *ribā*, *gharar*, and *maysir* (El-Gamal, 2006). The environmental dimension has also been discussed through *maqāṣid al-Sharīʿah* and fiqh al-bi'ah (Utama et al., 2019). The wider aims of Islamic finance are reflected in *maqāṣid al-Sharīʿah*, which encompasses the objectives of achieving welfare and avoiding harm. Dusuki et al. (2007) suggest that Islamic banking and finance should go beyond meeting the minimum requirements of shariah and help achieve the broader social and economic aims of shariah. As environmental degradation has the potential to threaten human life, health, and welfare, it is possible to integrate the environment into this framework. Al Banna & Rosyidah (2025) give priority to the preservation of the environment within *maqāṣid al-Sharīʿah*. Concern for the environment and public welfare can be encapsulated by the concepts of khilafah (stewardship) and *amānah* (trust) and the avoidance of harm (Saefullah, 2026). Accordingly, the aim of Islamic finance is to ensure that the availability of financial resources does not aggravate the already existing environmental problems caused by economic activities.

However, it should be recognized that there can be a negative impact on the environment, regardless of the compatibility of a given financial activity with shariah principles. The environmental impact of activities financed by the Islamic financial system, in the view of some (Irfany, Syam, et al., 2024; Suriani et al., 2024), can be positive; in the view of others, there can be negative climate impacts. Thus, this study uses Islamic Finance Theory and *maqāṣid al-Sharīʿah* as its main theoretical foundation, with an emphasis on the role of Islamic financial allocation as a critical mechanism affecting environmental outcomes. This framework provides the basis for differentiating the environmental effects of *ṣukūk* Holdings of Islamic Banks and Shariah-Compliant Financing to Industry. It is not assumed that all categories of Islamic finance generate similar environmental effects.

Distributional Impact Theory

According to the Distributional Impact Theory, the environment is degraded due to the distribution of wealth and power to generate and bear the cost of economic activities. Boyce (1994) refers to environmentally degrading activities as 'bads', and beneficiaries as 'winners'. Those who create 'bads' are rarely the decision makers, and in the case where power and wealth are unequally distributed, people benefiting from 'bads' are more likely to be decision makers. This is particularly true for the development of human capital since human development goes beyond economic growth and captures the expansion of people's choices and capabilities to lead a life they have reason to value and provide them with the opportunity to participate in decision-making processes that enhance environmental sustainability (United Nations Development Programme, 1990).

Even if development is not always detrimental to the environment, there are cases where improvements to the HDI are accompanied by increases in CO_2 emissions at various points in the emissions distribution, and where improvements in human development and welfare are accompanied by increases in environmental pressures. Alotaibi & Alajlan (2021) and Liu et al. (2023) provide evidence of the application of Distributional Impact Theory in the framework of the HDI variable. Islamic Finance Theory addresses the allocation of financial resources to promote the growth of the sustainable development goals and targets of a country, while the Distributional Impact Theory focuses on achieving a more equitable distribution of development benefits, capabilities, and the cost of environmental degradation.

The Influence of Islamic Bank *ṣukūk* Holdings on Carbon Emission

Ṣukūk are essential instruments of the Islamic capital market to mobilize funds to support economic activities. According to Islamic Finance Theory, *ṣukūk* can help channel funds into productive sectors of the economy while also adhering to the principles of Shariah. Nevertheless, based on the theory of *maqāṣid al-Sharīʿah*, the environmental impact of *ṣukūk* is determined by the activities that such *ṣukūk* finance. Therefore, it is erroneous to conclude that *ṣukūk* is environmentally beneficial just because it is Shariah-compliant. There are, however, studies that demonstrate the positive environmental impact of Shariah-compliant *ṣukūk*. Suriani et al. (2024) assessed global green *ṣukūk* issued between 2018 and 2022. Based on their study, all the green *ṣukūk* they analyzed reduced adverse climate effects in the short term and long term. Their study demonstrated that the environmental orientation of the projects funded determines the environmental impact of *ṣukūk*.

More recent evidence also suggests that the environmental consequences of broader *ṣukūk* financing require further analysis. Using heterogeneous panel ARDL estimators, Fodol et al. (2026) study non-labelled, general-purpose *ṣukūk* financing in 14 industrial OIC economies from 2013 to 2023. The study analyzes the relationship between general-purpose *ṣukūk* financing and CO_2 emissions and suggests the importance of the *maqāṣid al-Sharīʿah*, specifically the environment, in the evaluation of Islamic capital market activities. Even though some evidence on green and general-purpose *ṣukūk* is available, there is scope to study Islamic Bank *ṣukūk* Holdings and other Islamic financial and human development variables in a unified OIC framework. This study fills this research gap by analyzing the relationship between Islamic Bank *ṣukūk* Holdings and CO_2 emissions at various levels of the conditional emissions distribution.

H_1 : Islamic Bank *ṣukūk* Holdings (*ṣukūk* ownership by Islamic banks) has a negative effect on carbon emissions (CO_2) in OIC countries.

The Influence of Shariah Financing on Industry on Carbon Emissions

Shariah-compliant financing provides financing for economic activities that include industrial activities. From the perspective of Islamic Finance Theory, such financing should be directed toward activities that support real economic activities and are in line with Shariah. However, financing activities should not necessarily be in line with the principles of sustainability and environmental friendliness. Among the activities financed can still be fossil fuel-intensive industries and activities that are extensive in the use of energy and resources. There is sufficient evidence for this in the OIC countries. For example, Irfany, Syam, et al. (2024) study Islamic finance and carbon emissions in OIC countries and find that Islamic bank financing is positively related to carbon emissions.

Provide additional evidence showing that the environmental impact of Islamic finance varies by type of activity. Their research shows that assets of Islamic finance have a negative impact on CO_2 emissions, while the impact of Islamic banking financing has a limited impact on emission reduction, which the authors attribute to carbon-intensive projects. Therefore, the environmental effect of Islamic finance depends on the allocation of financial resources, as opposed to the financing mechanism being Shariah-compliant. Most of the existing studies have studied the impact of Islamic banking financing in an aggregated manner. Therefore, this study will examine Shariah-compliant financing at the industry level and will study the effect of Islamic Bank *ṣukūk* Holdings and HDI.

H_2 : Shariah-Compliant Finance to Industry has a positive effect on carbon emissions (CO_2) in OIC countries.

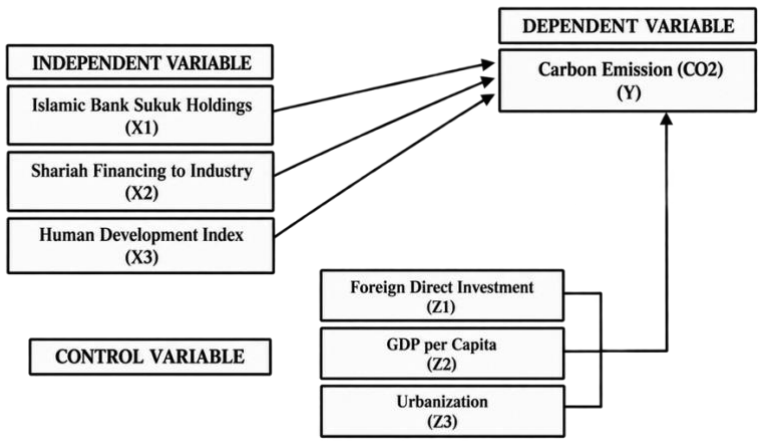
The Influence of Human Development Index on Carbon Emission

The Human Development Index (HDI) reflects levels of attainment in health and education and provides a more comprehensive indicator of quality of life than GDP alone (Statistical, 2025). Generally, higher HDI levels reflect better education and health services and greater environmental awareness (Silalahi, 2003). The dimension of distributional justice is also important. This is because the impact of environmental degradation from development may differ by levels of existing emissions. Alotaibi & Alajlan (2021) find that using quantile regression to analyze CO_2 emissions, in relation to different socioeconomic indicators, is justified and reflects the importance of understanding different environmental relationships rather than focusing on the average effect.

Existing research studies relate HDI and environmental quality; however, research that analyzes human development in the context of Islamic investment and OIC member states is scant. This study therefore bridges this research gap by analyzing the HDI in the context of Islamic Bank *ṣukūk* Holdings and Shariah-compliant Financial Systems and their influences across different carbon emission quantiles.

H_3 : The Human Development Index (HDI) has a negative effect on carbon emissions (CO_2) in OIC countries.

Figure 1. Research Framework



Methods

Research Design

This study uses quantitative methods to assess the effect of Islamic investments, which include the holdings of *ṣukūk* and Shariah-compliant industrial financing, as well as the Human Development Index (HDI), on carbon emissions (CO_2) in the member states of the Organization of Islamic Cooperation (OIC) from 2013 to 2023. The main technique used is Quantile Regression (QREG). It has been documented to effectively capture the heterogeneity of the impact of independent variables across different levels of the dependent variable (Koenker, 2004). For long-term relationship assessment and to augment the analysis, the study also incorporated the estimation of Fully Modified Ordinary Least Squares (FMOLS) (Pratomo et al., 2023). The joint use of these techniques allows the investigation of average relationships and effects, and assesses variability of effects across groups of countries belonging to OIC that are low emitters, medium emitters, and high emitters, thereby expanding the understanding of the low-carbon transition in OIC countries.

Data and Variable

This study uses purposive sampling to select 10 OIC member countries from 2013-2023. Sample selection is mostly influenced by the availability, completeness, and comparability of data for the variables included in the empirical model. The model requires annual observable data on Islamic bank *ṣukūk* holdings, Shariah-compliant financing to the industrial sector, Human Development Index (HDI), carbon emissions per capita, foreign direct investment (FDI), GDP per capita, and urbanization. The operational definitions, measurements, and data sources of these variables are presented in Table 1. The study explores Shariah-compliant financing to the industrial sector in the context of economic development. Considering the variability in data availability of Islamic finance indicators across OIC member countries, including countries with inadequate or inconsistent data, could substantially decrease the usable sample and adversely affect the comparability of the panel data. Thus, selected countries are those that fulfil the data availability requirements for the study period. This selection criterion helps to ensure the reliability and consistency of cross-country comparisons and the empirical estimation. However, the conclusions drawn should be considered in relation to the countries in question, rather than making unconditional assumptions about other OIC member states.

Table 1. Variable Operationalization

Varibale Type	Name	Definition and Measurement	Source
Dependent	Carbon Emissions (CO_2)	CO_2 emissions per capita (tons per capita per year)	SESRIC
Independent	Islamic Bank *ṣukūk* Holdings (*ṣukūk*)	Outstanding value of *ṣukūk* held by Islamic banks (in USD per capita)	SESRIC
Independent	Sharia Financing to Industry (Financing)	Proportion of financing to the industrial sector (ISIC C–F) relative to total Sharia-compliant financing (% of total financing)	SESRIC
Independent	Human Development Index (HDI)	Composite human development index (scale 0–1)	SESRIC
Control	Foreign Direct Investment (FDI)	Net inflow of foreign direct investment (% of annual GDP)	World Bank
Control	Gross Domestic Product per Capita (GDP)	GDP per capita per year (in USD)	World Bank
Control	Urbanization	Percentage of population living in urban areas (%)	World Bank

Source: (Irfany, Utami, et al., 2024) (modified)

Table 2. Country Classification Based on Carbon Emission Levels

Rank	Country	Mean	N	Group classification
1	Qatar	46.8916	11	Q3 – Highest
2	United Arab Emirates	21.8703	11	Q3 – Highest
3	Brunei Darussalam	19.5320	11	Q3 – Highest
4	Saudi Arabia	19.4799	11	Q2 – Middle
5	Oman	18.6981	11	Q2 – Middle
6	Malaysia	7.7864	11	Q2 – Middle
7	Jordan	2.4015	11	Q2 – Middle
8	Indonesia	2.1812	11	Q1 – Lowest
9	Pakistan	0.8807	11	Q1 – Lowest
10	Bangladesh	0.6120	11	Q1 – Lowest

In this study, classifying countries into quantile groups is based on the average carbon emission (CO_2) values for the period 2013-2023. This is to capture the emission variability across countries and to perform a more contextual analysis using the QREG approach.

The procedure begins by calculating the average CO_2 emission value for each country over the period under study. The resulting average emission values are then sorted in ascending order and divided into three quantile-based groups, classified as table 2.

Estimation Strategy

Before estimating the relationship between Islamic finance, the Human Development Index (HDI), and carbon emissions (CO_2), this study conducts some diagnostic tests to gauge statistical validity. These tests include checks for homogeneity, cross-sectional dependence, stationarity, and cointegration to verify the existence of long-run equilibrium relationships among the components of the system under study. The main estimation employs Quantile Regression (QREG) and is complemented by Fully Modified Ordinary Least Squares (FMOLS) to ensure long-term robustness.

Quantile Regression Model

As mentioned, to tackle the disparate distributions of carbon emissions across countries and time, Quantile Regression (QREG) is employed as the main model to estimate conditional means of the distribution of CO_2. Unlike OLS, which estimates conditional means, QREG estimates the dependent variable at various points in its distribution. To ease exposition and interpretation, we employ the (τ) = 0.25 (Q1), 0.5 (median), and 0.75 (Q3) quantiles of CO_2. QREG requires an assumption that the cross-country emission distribution is homoskedastic, which need not be true of the actual observations, and is usually satisfied for real-world data. The QREG model is formulated as follows.

$$\boldsymbol{Q_\tau(ln(CO2_{it}) = \alpha_\tau + X'_{it}\beta_\tau} \qquad (1)$$

where $Q_\tau(ln(CO2_{it})$ is the τ quantile of log per capita carbon emissions; α_τ is the quantile-specific intercept; and X'_{it} includes ln(*ṢUKŪK*), ln(FIN), ln(HDI), ln(FDI), n(GDP), and ln (URBAN). β_τ is the elasticity of the regressors at the given τ level. The coefficient vector β_τ represents the elasticity at the respective quantiles. QREG assumes that regression parameters for different cross-sections are the same.

Homogeneity Test

This test is used to verify if OIC countries respond the same to *ṣukūk* and Islamic financing in terms of carbon emissions. HDI is also included to determine if these parameters are dependent. The Likelihood Ratio (LR) test is used to verify the null hypothesis of parameter homogeneity, which is defined by the following equation:

$$\boldsymbol{LR = 2(lnL_{UR} - lnL_R)} \quad (2)$$

Rejecting the null means that country responses are heterogeneous and various types of models should be used to capture these country responses.

Cross-sectional Dependence Test

Cross-sectional dependence in residuals is tested using Pesaran's scaled LM approach. The null hypothesis in this case is that residuals are independent, and the alternative hypothesis is that residuals are dependent.

$$\boldsymbol{LM_{Pesaran} = \sqrt{\frac{2}{N(N-1)}\sum_{i<j}(T\hat{\rho}_{ij}^2 - 1)}} \quad (3)$$

Stationarity Test

To prevent spurious regressions, the PP-Fisher test is used to evaluate stationarity of the variables at levels and first differences, under the three specified cases: no constant, with a constant, and with a constant and trend. Rejection of the null hypothesis indicates the presence of stationarity. Variables confirmed to be I(1) are subjected to the test for cointegration.

No constant and trend:

$$\boldsymbol{\Delta Y_{i,t} = \delta Y_{i,t-1} + \mu_{i,t}} \quad (4)$$

With constant:

$$\boldsymbol{\Delta Y_{i,t} = \alpha + \delta Y_{i,t-1} + \mu_{i,t}} \quad (5)$$

With constant and trend:

$$\boldsymbol{\Delta Y_{i,t} = \alpha + \beta T + \delta Y_{i,t-1} + \mu_{i,t}} \quad (6)$$

Cointegration Test

If variables are I(1), cointegration tests assess long-run relationships. Residuals from the long-run model are extracted and tested for stationarity using the Augmented Dickey–Fuller (ADF) test. Stationary residuals confirm cointegration:

$$\Delta\hat{\varepsilon}_{it} = \rho\hat{\varepsilon}_{i,t-1} + \sum_{k=1}^{p} \emptyset_k \Delta\hat{\varepsilon}_{i,t-k} + \nu_{it} \qquad (7)$$

Fully Modified Ordinary Least Squares (FMOLS)

Once cointegration is confirmed, FMOLS is applied to estimate long-run elasticities while correcting for serial correlation and endogeneity. FMOLS extends OLS through nonparametric corrections, making it suitable for heterogeneous panels. Here, FMOLS serves as a robustness check for QREG, offering complementary long-run average estimates:

$$\hat{\boldsymbol{\beta}}^{\mathbf{FMOLS}} = \left[\sum_{\mathbf{i=1}}^{\mathbf{N}} (\mathbf{X_{it}} - \overline{\mathbf{X}}_{\mathbf{i}})'(\mathbf{X_{it}} - \overline{\mathbf{X}}_{\mathbf{i}})\right]^{-1} \sum_{\mathbf{i=1}}^{\mathbf{N}} (\mathbf{X_{it}} - \overline{\mathbf{X}}_{\mathbf{i}})' (\mathbf{Y}_{\mathbf{it}}^{*} - \mathbf{T}_{\hat{\gamma}_{\mathbf{i}}}) \qquad (8)$$

Descriptive Statistics

The descriptive statistics of the variables analyzed are in Table 3. Per capita CO_2 emissions have a mean of 6.103 with a highly right-skewed distribution, with a skewness of 10.07 and kurtosis of 104.3. *ṢUKŪK* and Islamic Industrial financing (FINANCING) also depict high levels of asymmetry, as evidenced by a high absolute value of both skewness and kurtosis, which implies the presence of extreme outliers. The HDI has a mean of 0.772 and a negative skewness of -0.936, implying a relatively less right-skewed distribution. Among the control variables, FDI and urbanization (URBAN) also have right-skewed distributions. GDP, in current US$ billions, has a mean of 368.238 billion, a median of 307.493 billion, a maximum of 1,371.167 billion, and a minimum of 11.400 billion. Its standard deviation of 343.999 billion reflects large cross-country and cross-time variation in GDP. Based on the descriptive statistics, a case can be made that there is non-normality for several of the variables. This study employs quantile regression (QREG) to examine how relationships between the explanatory variables and CO_2 emissions vary in the conditional distribution of carbon emissions, that is, at the lower, medium, and upper levels.

Table 3. Descriptive Statistics

	CO_2	*Ṣukūk*	Financing	HDI	FDI	GDP	Urban
Mean	6.103	257.09	7.195	0.772	12.245	368.238	5.111
Median	5.513	7.807	6.735	0.800	7.836	307.493	4.382
Maximum	66.75	27407	94.10	0.900	474.0	1371.167	99.36
Minimum	3.846	4.852	4.519	0.500	0.039	11.400	3.475
Std. Dev.	5.886	2612	8.390	0.123	44.46	343.99	9.074
Skewness	10.07	10.34	10.24	-0.936	10.33	1.210	10.32
Kurtosis	104.3	108.0	106.6	2.979	107.7	0.665	107.7
Observations	110	110	110	110	110	110	110

Correlation Matrix

From Table 4, a moderate positive correlation is shown between CO_2 and Islamic industrial financing (0.491) and FDI (0.555). This means that higher financing and foreign investments tend to increase emissions. A moderate negative or low correlation is seen between CO_2 and *ṣukūk*, GDP, HDI and urbanization. This indicates a weak or no linear relationship. Correlation among the independent variables may indicate multicollinearity, in particular GDP and HDI (above 0.79), as well as urbanization and HDI (0.298), and FDI (0.315). Nevertheless, no extreme correlations among the variables are indicated that would raise concerns about the regression estimates.

Table 4. Correlation Matrix

	CO_2	*Ṣukūk*	Financing	FDI	GDP	HDI	Urban
CO2	1.000	-0.093	0.491	0.555	-0.213	0.012	-0.040
Ṣukūk	-0.093	1.000	-0.219	0.315	0.302	0.298	0.202
Financing	0.491	-0.219	1.000	0.368	0.128	0.309	0.181
FDI	0.555	0.315	0.368	1.000	-0.098	0.063	-0.119
GDP	-0.213	0.302	0.128	-0.098	1.000	0.801	0.798
HDI	0.012	0.298	0.309	0.063	0.801	1.000	0.740
Urban	-0.040	0.202	0.181	-0.119	0.798	0.740	1.000

Results and Discussion

Result

Unit Root Test

According to the results of the PP-Fisher test (Table 5), the variables are non-stationary at level (p-value > 0.05) but become stationary at first difference (p-value < 0.05). The same outcome is true for the main variables (CO_2, *ṣukūk*, Financing, HDI) and control variables (FDI, GDP and Urbanization). Hence, all variables are classified as I(1). This situation fulfills the condition to perform the test for cointegration to find out whether there is a long-run relationship among the variables.

Table 5. Unit Root Test

Variable	PP-Fisher	
	Level	1st Difference
CO2	0.435	0.000
Ṣukūk	0.818	0.018
Financing	0.726	0.004
HDI	0.993	0.002
FDI	0.251	0.000
GDP	0.182	0.046
Urban	0.768	0.000

Table 6. Diagnostic Test

TEST	STATISTIC	PROB.
Homogeneity Test		
Likelihood Ratio (LR)	2.069015	0.0641
Cointegration Test		
Panel PP-Statistic	-15.854	0.000
Panel ADF-Statistic	-9.142	0.000
Group PP-Statistic	-17.068	0.000
Group ADF-Statistic	-8.563	0.000
Cross-sectional dependency Test		
Pesaran CD	-1.437	0.150

Diagnostic Tests

The test for homogeneity shows an LR value of 2.069 (p = 0.0641), indicating that the coefficients are homogeneous across the cross-sections and permitting the use FMOLS. The cointegration tests (Panel and Group PP/ADF) show a long-run equilibrium among the variables and a p-value of 0.000. The test for cross-sectional dependence, using Pesaran's CD, shows a p-value of 0.150 and hence, no cross-sectional dependence. These results substantiate the use of the panel model and FMOLS estimation.

Quantile Regression (QREG) Estimation Results

Table 7 shows that the influence of the variables on carbon emissions is different across the quantiles based on emission level. For the lower quantile (τ = 0.25), the influence of Sukuk and HDI is negative. The rest of the variables, Financing, FDI, and urbanization, are positive, and GDP is not significant. For the middle quantile (τ = 0.50), the influence of *ṣukūk* is negative and significant at the 10% level. Financing is positive and significant. HDI is negative and significant. FDI and urbanization are positive and significant. GDP is not significant. For the higher quantile (τ = 0.75), only Financing is positive and significant (0.739). The rest of the variables are not significant. The Wald test shows the joint significance of the variables across all three quantiles (p-value = 0.000). Thus, the QREG model captures well the heterogeneity of the variables with respect to their impact on carbon emissions of the OIC countries.

Table 7. QREG Estimation

Variable	τ = 0.25 (Q1)		τ = 0.50 (Q2)		τ = 0.75 (Q3)	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
C	-0.774	0.442	-0.148	0.898	4.383	0.093
Ṣukūk	-0.119	0.096*	-0.128	0.092*	-0.044	0.549
Financing	0.277	0.007***	0.337	0.006***	0.739	0.000***
HDI	-4.250	0.000***	-3.476	0.000***	1.623	0.175
FDI	0.400	0.000***	0.312	0.006***	0.082	0.172
GDP	0.042	0.119	0.046	0.110	0.017	0.537
URBAN	1.121	0.000***	0.977	0.002***	-1.120	0.083*
Wald Test		0.000***		0.000***		0.000***

Fully Modified Ordinary Least Squares (FMOLS) Estimation Results

According to FMOLS, all variables are significant, thus confirming the presence of a long-term relationship between Islamic investment, human development, macroeconomic factors, and carbon emissions in OIC member countries. A negative effect is observed for both Sukuk and HDI, indicating that the adoption of Islamic finance and human capital has a negative effect on CO2 emissions. A positive effect is observed for both Financing and FDI, and urbanization. This implies that although economic growth is positive for CO2 emissions, financing is relatively positive and FDI is neutral. A negative effect is observed for per capita GDP. Unlike QREG, which captures variations across quantiles, FMOLS provides a comprehensive long-term perspective. The directional relationships between the two streams of the data reinforce one another.

Table 8. FMOLS Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ṢUKŪK	-0.193	0.015	-13.285	0.000***
FINANCING	0.098	0.027	3.570	0.001***
HDI	-0.659	0.199	-3.303	0.002***
FDI	0.437	0.017	25.774	0.000***
GDP	-0.308	0.021	-14.682	0.000***
URBAN	1.464	0.058	25.204	0.000***

Discussion

The Role of Islamic Bank *ṣukūk* Holdings in Reducing Carbon Emissions in OIC Countries

Ṣukūk Holdings tend to exhibit a negative and significant impact on lower (Q1) and middle (Q2) quantiles. However, in the upper quantile (Q3), *ṣukūk* Holdings are found to be insignificant. The overall results of the estimation indicate that Islamic financing instruments based on *ṣukūk* are associated with the low to medium emission level of carbon in the OIC countries (Barokah & Bandiyono, 2025; Nasution et al., 2024). The results of the FMOLS also support the above conclusions, especially the presence of significant negative long-term coefficients. From the theoretical point of view, these conclusions correspond to the Green Islamic Finance approach, according to which Shariah-compliant funds are invested in areas that are friendly

to the environment and other sustainability issues (Anwar, 2024). From the principles of Islamic finance, this relationship can also be seen in relation to the Islamic principle of *maṣlaḥah* (public welfare), whereby the use of Shariah-compliant funds is aimed at supporting (or preventing a negative situation from occurring) a beneficial and sustainable activity. The environmental impact of *ṣukūk* is also determined by the sector to which Shariah-compliant funds are allocated and monitored. There is no guarantee that funds are used in projects with low carbon emissions and other environmental sustainability activities.

The results are in line with studies on OIC countries showing that Islamic financial development, renewable energy, and CO_2 emissions are negatively related to each other (Mu'min et al., 2024). The results also align with the distinction between Islamic financial assets and bank financing, and the environmental implications are different based on the activities funded (Irfany, Syam, et al., 2024). The Q3 coefficient was insignificant, indicating that a negative association between *ṣukūk* holdings and CO_2 emissions is not statistically proven for high CO_2-emitting countries, likely due to the size of existing industrial activities or the nature of projects funded. This warrants further empirical testing. Therefore, Hypothesis H1 is accepted for Q1 and Q2, but the result was not uniform for all quantiles. The results showed that the use of proceeds for renewable energy and/or energy efficiency projects, as well as environmental screening, could help strengthen *ṣukūk* in achieving lower emissions.

The Role of Shariah-Compliant Financing to Industry in Reducing Carbon Emissions in OIC Countries

Of all the models tested, Shariah-compliant financing of industry exhibited the most consistent and the most significant results. The positive and significant results at all three QREG quantiles and in FMOLS estimations suggest that Shariah-compliant financing of industry is likely to increase carbon emissions (Irfany & Ramadhini, 2025; Maulidiyah & Auwalin, 2021). This may be because the funded industries have not adopted sufficient environmentally friendly practices (Ihsan et al., 2024; Irfany & Ramadhini, 2025; Maulidiyah & Auwalin, 2021). This may be because these industries continue to utilize fossil fuels or rely on other conventional technologies (Ihsan et al., 2024). From the perspective of environmental economics, this may be due to the scale effect: the impact on emissions may not be reduced just because financing is Shariah-compliant.

The results show a positive relationship between Islamic bank financing and CO_2 emissions per capita in line with findings from OIC countries (Irfany, Utami, et al., 2024). Similarly, sectoral evidence for Indonesia indicates that the environmental impact of Islamic financing varies for different economic activities and that financing for some sectors is associated with higher emissions (Farabi et al., 2025). Positive coefficients for Q1, Q2, and Q3 indicate that the relationship holds for the conditional emission distribution that was studied, though it does not necessarily mean the same effect size is associated with all quantiles. Hypothesis H2 is therefore accepted if it postulates a positive relationship between industrial financing and emissions. An emission-reducing effect, however, should also be considered unsupported. The results emphasize the need for better environmental screening and energy-efficiency requirements, as well as more funding for the incorporation of Islamic financing of low-carbon industrial technologies, to enable Islamic financing to contribute to a green industrial transition.

The Role of Human Development Index in Reducing Carbon Emissions in OIC Countries

The negative and significant impact of HDI is seen in Q1 and Q2, but becomes insignificant in Q3. For FMOLS, the negative and significant impact of HDI is seen in the long run. This shows that improvements in the health and education of the population, as well as an increase in income, contribute to a reduction in carbon emissions. This is particularly the case for low- and medium-emission countries (Hamidah & Anggraeni, 2024; Pangestu & Ayuningsasi, 2024). From a theoretical perspective, this is in line with the sustainable development perspective, which highlights the importance of the interrelationships between human welfare, environmental quality, and sustainable development (Suryani et al., 2020). More education may enhance environmental awareness and facilitate the choice of and the adoption of cleaner technologies. Additionally, educational enhancement may foster the modification of environmental policy impacts. Enhancement of the human and institutional capacity may improve environmental governance and facilitate better implementation of environmental policies. However, increased human development may also lead to increased consumption and energy demand, meaning that the net impact of human development on carbon emissions is the result of the balance between these two potentially opposing effects.

Negative and significant coefficients in Q1 and Q2 indicate that the association of HDI with emission reduction is more prevalent in the lower and middle parts of

conditional emissions. The insignificance of HDI in Q3 may indicate that improvement in human development alone is not enough to balance the emissions from energy-intensive production and fossil-fuel dependence. The negative coefficient of FMOLS in the long run suggests a relationship, but in the absence of supporting evidence, it cannot be interpreted as a causal relationship. Hypothesis H3 is therefore accepted for Q1 and Q2, and is also supported by the negative coefficient of FMOLS in the long run, although the relationship in Q3 is not statistically significant. The results indicate that, in addition to strategies aimed at improving human development, other policies, including clean energy, environmental education, and infrastructure, should be devised to help households and firms adopt strategies to reduce carbon emissions.

The Role of Macroeconomic Variables in Reducing Carbon Emissions in OIC Countries

The effects of the three control variables (FDI, GDP per capita, and Urbanization) depend on which emission quantiles we consider. In FDI, the coefficient is positive and significant for both lower and middle quantiles and becomes insignificant for the upper quantile. Thus, for low and medium emissions observations, FDI is related to increasing emissions (Winda & Falianty, 2023). This supports the pollution haven hypothesis, which suggests that some developing countries are likely to attract pollution-intensive activities from countries with stringent environmental regulations (Dzikrullah & Desmawan, 2023). The positive FDI coefficient, however, does not prove the pollution haven hypothesis. It is possible that foreign investments increase emissions through expansion of production and energy demand. For the upper quantile, the coefficient of the Q3 variable is insignificant. This may reflect differences in the composition of the FDI, as well as the state's ability and effort to control environmental pollution. However, these are speculative. For GDP, the coefficient is negative and significant for both lower and middle quantiles and is insignificant for the upper quantile. For the FMOLS regression, GDP is significant and negative for all quantiles.

The association between urbanization and energy consumption has also been discussed in Indonesia (Sari & Sari, 2025). Urbanization has a positive impact in Q1 and Q2. This impact becomes negative and weakly significant in Q3. Urbanization has a highly significant positive impact in FMOLS. This shows that urbanization tends to increase carbon emissions. However, in higher quantiles, this effect may reverse. Positive coefficients of Q1 and Q2 may show an increase in transport

demand and use of energy and electricity infrastructure. The negative and weakly significant Q3 coefficient may show the presence of better and more efficient urban transport and/or infrastructure systems. However, this is not directly tested by the current model. The positive coefficient of FMOLS shows that the relation between urbanization and emissions is positive in the long run. Results imply that policy responses should take into consideration production, energy, and environmental structures in combination with investment and economic activities. This is more important when considering urbanization.

Conclusion

Results from both quantile regression and FMOLS estimations show that, in the lower and middle quantiles, holdings of Islamic bank *ṣukūk* are negatively and significantly associated with carbon emissions. However, in the upper quantile, the association is not significant. Islamic industrial financing, on the other hand, is positively and significantly associated with carbon emissions in all quantiles and in the long run. The HDI is negatively associated with carbon emissions in the lower and middle quantiles and in the long run, and is not significantly associated with carbon emissions in the upper quantile. From the results, it can be observed that, depending on the level of carbon emissions, there are implications on the environment and human development from the use of Islamic finance. From a policy perspective, all Islamic financial institutions should implement the same changes regarding the environmental screening of *ṣukūk* and industrial financing and prioritize renewable and clean energy. In addition, human development policies should include investments in clean energy and sustainable infrastructure to support emission reduction.

The study has several limitations. First, the sample comprises only 10 OIC countries, limiting the generalizability of the findings to the larger OIC membership. Second, the estimation results demonstrate statistical relationships, but do not independently establish the causal mechanisms relating to Islamic finance, human development, and carbon emissions. The analysis does not account for the distinction between green and non-green finance, or account for variations in countries' energy composition and environmental regulations. Future work should expand the sample of countries and the analysis period, distinguish financing by instrument and sector, and consider other variables relating to the green transition such as the consumption of renewable energy, environmental regulations and the adoption of green technologies. Also, the study of non-linear relationships and causal

mechanisms may define the conditions in which Islamic finance has the potential to alleviate challenges relating to carbon-emissions reduction in OIC countries.

BIBLIOGRAPHY

Al-Qaradawi, Y. (2001). *Riʿāyat al-Bīʾah fī Sharīʿat al-Islām*. Dār al-Shurūq.

Al Banna, H., & Rosyidah, U. (2025). The Construction of Ecological Fiqh from the Perspective of Yusuf al-Qardhawi. *Ma'mal: Jurnal Laboratorium Syariah Dan Hukum*, *7*(2), 214–233. https://doi.org/10.15642/mal.v7i2.468

Al Hasyim, M. M. (2025). Organisasi Kerja Sama Islam (OKI) dan Transisi Energi di Tengah Kompleksitas Kawasan Timur Tengah. *JISIP UNJA (Jurnal Ilmu Sosial Ilmu Politik Universitas Jambi)*, *9*(1), 38–48. https://doi.org/10.22437/jisipunja.v9i1.42953

Ali, S., Yusop, Z., & Meo, M. S. (2022). Asymmetric openness-environment nexus in most open OIC countries: new evidence from quantile-on-quantile (QQ) estimation. *Environmental Science and Pollution Research*, *29*(18), 26352–26370. https://doi.org/10.1007/s11356-021-17473-8

Alotaibi, A. A., & Alajlan, N. (2021). Using Quantile Regression to Analyze the Relationship between Socioeconomic Indicators and Carbon Dioxide Emissions in G20 Countries. *Sustainability*, *13*(13), 7011. https://doi.org/10.3390/su13137011

Ameziane, M. (2024). Islamic Financial Inclusion and Economic Growth in Oic Countries: Panel Quantile Regression Analysis. *Journal of Islamic Monetary Economics and Finance*, *10*(3), 609–630. https://doi.org/10.21098/jimf.v10i3.2150

Anwar, K. (2024). *Green Economy and Sustainable Development: Jalan Menuju Industri yang Berkelanjutan*. Penerbit NEM (PT Nasya Expanding Management).

Ardiansah, R. (2024). Analisis Pengaruh Sektor Industri Halal Terhadap Pertumbuhan Ekonomi di Negara-Negara Anggota OKI. *Jurnal Keuangan Dan Perbankan Syariah*, *3*(2), 203–226. https://doi.org/10.24260/jkubs.v3i2.3188

Bahri, Z., & Aprilianti, V. (2023). *Menuju Kesejahteraan Berkelanjutan: Pemahaman terhadap Pertumbuhan Ekonomi Klasik, Neoklasik, Islam, Green Economy, dan Blue Economy*. Nas Media Pustaka.

Barokah, I. N., & Bandiyono, A. (2025). The Dynamics of Green Bond Effectiveness in Achieving Sustainable Development: A Comparative Study with a Scoping

Review Approach. *JAE (JURNAL AKUNTANSI DAN EKONOMI)*, *10*(1), 110–123. https://doi.org/10.29407/jae.v10i1.24792

Behera, S. R., & Dash, D. P. (2017). The effect of urbanization, energy consumption, and foreign direct investment on the carbon dioxide emission in the SSEA (South and Southeast Asian) region. *Renewable and Sustainable Energy Reviews*, *70*, 96–106. https://doi.org/10.1016/j.rser.2016.11.201

Boyce, J. K. (1994). Inequality as a cause of environmental degradation. *Ecological Economics*, *11*(3), 169–178. https://doi.org/10.1016/0921-8009(94)90198-8

Chapra, M. U. (2008). *The Islamic Vision of Development in the Light of the Maqasid Al-Shari'ah*. Islamic Research and Training Institute. https://isdbinstitute.org/product/the-islamic-vision-of-development-in-the-light-of-the-maqasid-al-shariah/

Dika, R. P., Bella, S., & Apriyanti, N. (2024). *Investasi Saham Syariah*. CV Gita Lentera.

Dusuki, W, A., & Abozaid. (2007). A critical appraisal on the challenges of realizing maqasid al-Shariaah in Islamic banking and finance. *International Journal of Economics, Management and Accounting*, *15*(2), 143–165. https://doi.org/10.31436/ijema.v15i2.133

Dzikrullah, F. A., & Desmawan, D. (2023). Pengaruh Pertumbuhan Ekonomi dan Forign Direct Investment terhadap Degradasi Lingkungan di ASEAN-5. *Jurnal Ekonomi Dan Bisnis (EK&BI)*, *6*(2), 138–147. https://doi.org/10.37600/ekbi.v6i2.1137

El-Gamal, M. A. (2006). *Islamic Finance: Law, Economics, and Practice*. Cambridge University Press. https://doi.org/10.1017/CBO9780511753756

Fahlevi, M. F., & Wirdyaningsih, W. (2024). Analisis Tantangan dan Peluang Perkembangan Green Sukuk di Indonesia. *Syntax Literate ; Jurnal Ilmiah Indonesia*, *9*(10), 5663–5676. https://doi.org/10.36418/syntax-literate.v9i10.16847

Farabi, A., Putri Kurniadi, A., Dasilva, H., Thoha, M., Karimi, K., Suhendra, A., Abinda Firdaus, I., Setiawan, S., Asrori, A., & Salim, Z. (2025). Islamic Banking Finance and Environmental Sustainability: Sector-Level Analysis from Indonesia. *International Journal of Energy Economics and Policy*, *15*(5), 695–704. https://doi.org/10.32479/ijeep.20331

Fodol, M. Z., & Aslan, H. (2026). Mapping the evolution of Islamic finance for sustainability: a bibliometric analysis. *Sustainability Accounting, Management and Policy Journal*, *17*(4), 1020–1053. https://doi.org/10.1108/SAMPJ-08-2024-0926

Fodol, M. Z., Dawai, A. A., Awdalkrem, A., Aslan, H., & Altıntaş, N. (2026). Ṣukūk Financing and CO_2 Emissions in OIC Industrial Economies: Evidence from a Heterogeneous Panel ARDL Model. *International Journal of Islamic Finance and Sustainable Development*, *18*(2), 68–89. https://doi.org/10.55188/ijifsd.v18i2.1358

Hamidah, I., & Anggraeni, L. (2024). Pencapaian tujuan SDG's kapasitas hidup sehat dan sejahtera melalui pola hidup rendah karbon Pekerja Migran Indonesia di Johor Bahru, Malaysia. *Jurnal Abmas*, *24*(2), 145–152. https://doi.org/10.17509/abmas.v24i2.75855

Herlambang. (2025). *BMKG: 2024 Jadi Tahun Terpanas Sepanjang Sejarah, Perubahan Iklim Kian Membahayakan Kesehatan Publik*.

Hidayat, M. S. (2023). Mengurai Potensi Ekonomi Syariah sebagai Solusi Krisis Keuangan Global: Kajian Mendalam melalui Studi Literatur. *ALAMIAH : Jurnal Muamalah Dan Ekonomi Syariah*, *4*(02), 21–25. https://doi.org/10.56406/jurnalalamiah.v4i02.220

Ihsan, M., Ahdiya, M. A., & Rahmadi, R. A. (2024). Tantangan dan Potensi Ekonomi Syariah di Indonesia dengan Memahami Perbedaan Ekonomi Konvensional. *Islamic Education*, *3*(2), 37–53. https://doi.org/10.68352/education.v3i2.1070

Irfany, M. I., & Ramadhini, F. (2025). Peran Keuangan Syariah dalam Mitigasi Perubahan Iklim Global. *Policy Brief Pertanian, Kelautan, Dan Biosains Tropika*, *7*(1), 1164–1170. https://doi.org/10.29244/agro-maritim.0701.1164-1170

Irfany, M. I., Syam, M. I. N., & Haq, D. A. (2024). The Impact of Islamic Finance on Carbon Emissions: Lessons from OIC Countries. *International Journal of Energy Economics and Policy*, *14*(3), 198–205. https://doi.org/10.32479/ijeep.15776

Irfany, M. I., Utami, A. D., Lubis, D., Ramadhini, F., Suwari, L. F., Maula, N. R., Fitriyatustany, F., & Haq, D. A. (2024). Islamic Finance and Environmental Sustainability: Empirical Insight from OIC Countries. *International Journal of Energy Economics and Policy*, *14*(6), 707–715. https://doi.org/10.32479/ijeep.17400

Islamic Corporation for the Development of the Private Sector, & London Stock Exchange Group. (2024). *Islamic finance development report 2024*. https://www.lseg.com/content/dam/data-analytics/en_us/documents/reports/lseg-islamic-finance-development-report-2024.pdf

Kamalu, K., & Ibrahim, W. H. B. W. (2023). The Effect of Islamic Financial Development and Human Development on Income Inequality: Does Islamic

Finance Kuznets Curve Valid in the OIC Countries? *Journal of Islamic Monetary Economics and Finance*, *9*(4), 661–684. https://doi.org/10.21098/jimf.v9i4.1903

Koenker, R. (2004). Quantile regression for longitudinal data. *Journal of Multivariate Analysis*, *91*(1), 74–89. https://doi.org/10.1016/j.jmva.2004.05.006

Li, Z., Patel, N., Liu, J., & Kautish, P. (2023). Natural resources-environmental sustainability-socio-economic drivers nexus: Insights from panel quantile regression analysis. *Resources Policy*, *86*, 104176. https://doi.org/10.1016/j.resourpol.2023.104176

Liu, Y., Poulová, P., Pražák, P., Ullah, F., & Nathaniel, S. P. (2023). Infrastructure development, human development index, and CO2 emissions in China: A quantile regression approach. *Frontiers in Environmental Science*, *11*. https://doi.org/10.3389/fenvs.2023.1114977

Maulidiyah, D. R., & Auwalin, I. (2021). Pengaruh Pembiayaan Perbankan Syariah terhadap Kualitas Lingkungan Hidup Tingkat Provinsi di Indonesia. *Jurnal Ekonomi Syariah Teori Dan Terapan*, *8*(4), 439. https://doi.org/10.20473/vol8iss20214pp439-450

Miyan, M. S., Cheong, C. W. H., Sharif, A., & Afshan, S. (2026). Bridging faith and future: the role of Islamic finance in driving environmental sustainability in OIC economies. *International Journal of Islamic and Middle Eastern Finance and Management*, *19*(5), 1181–1206. https://doi.org/10.1108/IMEFM-04-2025-0278

Mu'min, M. S., Rusanti, E., & Amru, M. (2024). How Do Islamic Finance Development and Renewable Energy Affect CO2 Emissions? New Insights from OIC Countries. *International Journal of Energy, Environment, and Economics*, *31*(3), 433–456. https://novapublishers.com/shop/how-do-islamic-finance-development-and-renewable-energy-affect-co2-emissions-new-insights-from-oic-countries/

Nasution, Y. S. J., Siregar, S., Zen, M. A. S., Harahap, E. F., Syafrizal, R., & Sundari, D. (2024). Peran Islamic Social Finance di Indonesia Menuju Sustainable Development Goals (SDGs). *Jurnal Penelitian Ekonomi Akuntansi (JENSI)*, *8*(2), 333–347. https://doi.org/10.33059/jensi.v8i2.10640

Nuraini, U. (2024). Produk Investasi Syariah dan Perannya dalam Meningkatkan Stabilitas Keuangan dan Ketahanan Ekonomi. *ACTIVA: Jurnal Ekonomi Syariah*, *7*(1), 1–13. https://jurnal.stitnualhikmah.ac.id/index.php/activa/article/view/2605

Pangestu, R. C. K., & Ayuningsasi, A. A. K. (2024). Pengaruh Konsumsi Energi Sektor Industri, Rumah Tangga, dan Transportasi terhadap Emisi Karbon di

Indonesia. *Inisiatif: Jurnal Ekonomi, Akuntansi Dan Manajemen*, *3*(4), 297–311. https://doi.org/10.30640/inisiatif.v3i4.3154

Pratomo, W., Rusydiana, A., Riani, R., Lubis, R., Marlina, L., Putra, P., & Nurismalatri, N. (2023). Does Renewable Energy Consumption a Driver for Economic Growth? Panel Data Analysis in Selected OIC Countries. *International Journal of Energy Economics and Policy*, *13*(6), 573–580. https://doi.org/10.32479/ijeep.14955

Qur'an, N., & Akhmadi, M. H. (2025). Green Sukuk: Instrumen Pembiayaan Sektor Hijau untuk Mendukung Pembangunan Berkelanjutan Tahun 2018 - 2023. *Bisnis-Net Jurnal Ekonomi Dan Bisnis*, *8*(1), 464–476. https://doi.org/10.46576/bn.v8i1.5695

Saefullah, M. (2026). Fiqh al-Bi'ah: Kontribusi Pemikiran Yusuf al-Qaradawi terhadap Pelestarian Lingkungan Muhamad. *Ma'had Aly Journal of Islamic Studies*, *5*(1), 45–60. https://doi.org/10.63398/y10es248

Sari, R. N., & Sari, Y. P. (2025). Pengaruh Urbanisasi Terhadap Konsumsi Energi di Indonesia. *Media Riset Ekonomi Pembangunan (MedREP)*, *2*(1), 177–184. https://medrep.ppj.unp.ac.id/index.php/MedREP/article/download/183/126

Sethi. (2023). Apakah Dinamika Bantuan-FDI-Pembangunan Keuangan merupakan Pelopor Pertumbuhan Ekonomi? Perspektif Ekonomi Asia yang Berkembang. *Silahul Mu'Min, M., Rusanti, E., & Amru, M. (2024). How Do Islamic Finance Development and Renewable Energy Affect Co2 Emissions? New Insights from Oic Countries. International Journal of Energy, Environment and Economics*, *31*(3), 433–456.

Silalahi, U. (2003). Relevansi Kebijakan Human-Centered Development dan Perbaikan Kualitas Pendidikan dalam Pengembangan Kualitas Sumberdaya Manusia Indonesia. *Jurnal Administrasi Publik*, *2*(1), 87–107. https://journal.unpar.ac.id/index.php/JAP/article/view/641

Siregar, S. V., Wardhani, R., Mita, A. F., & Setyaningrum, D. (2024). *Masa Depan Hijau: Membangun Keberlanjutan Lingkungan dan Pembangunan Berkelanjutan*. Salemba Empat.

Smolo, E. (2026). Does Islamic banking promote environmental sustainability? Evidence from QISMUT countries. *Green Finance*, *8*(1), 113–141. https://doi.org/10.3934/GF.2026005

Statistical, E. and S. R. and T. C. for I. C. (2025). *OIC Statistics Database (OICStat)*. SESRIC. https://oicstat.sesric.org/query

Suriani, S., Masbar, R., Agustina, M., & Khairul, A. D. (2024). Do Global Green Sukuk affect on Climate Change? Evidence in Issuing Countries. *International Journal*

of Energy Economics and Policy, *14*(1), 98–107. https://doi.org/10.32479/ijeep.14987

Suryani, S., Ihwanudin, N., & Saripudin, U. (2020). Keseimbangan dalam Produksi, Distribusi dan Konsumsi sebagai Upaya Pembangunan Ekonomi Berkelanjutan. *Al-Insyiroh: Jurnal Studi Keislaman*, *6*(2), 33–60. https://doi.org/10.35309/alinsyiroh.v6i2.3918

United Nations Development Programme. (1990). *Human Development Report 1990*. UN. https://doi.org/10.18356/7007ef44-en

Utama, R. W. A., Muhtadi, R., Arifin, N. R., & Mawardi, I. (2019). Tinjauan Maqashid Syariah dan Fiqh al-Bi'ah dalam Green Economy. *Jurnal Ekonomi Islam*, *10*(2), 242–259. https://journal.uhamka.ac.id/index.php/jei/article/view/3808

Uysal, M., Ozturk, Z., & Dastan, E. (2026). The relationship between Islamic financial development and renewable energy consumption: evidence from OIC countries. *International Journal of Islamic and Middle Eastern Finance and Management*, 1–28. https://doi.org/10.1108/IMEFM-02-2026-0133

Winda, B. S., & Falianty, T. A. (2023). Pengaruh Foreign Direct Investment Terhadap Emisi Gas CO2 di Negara G20. *Al Qalam: Jurnal Ilmiah Keagamaan Dan Kemasyarakatan*, *17*(3), 1989. https://doi.org/10.35931/aq.v17i3.2163

World Meteorological Organization. (2025). *State of the Global Climate 2024*. https://wmo.int/publication-series/state-of-global-climate/state-of-global-climate-2024