

The Nexus between Financial Development and Carbon Emission in OIC Countries

Mohammad Zen Nasrudin Fajri^{1*}, Ikhsanul Amal², Abdul Fareed Delawari³,
Ahmad Suminto⁴

^{1,4}Centre for Islamic Economic Studies, Faculty of Economics and Management,
Universitas Darussalam Gontor, Indonesia

²Department of Islamic Economics, Faculty of Economics and Management,
Universitas Darussalam Gontor, Indonesia

³Da Afghanistan Bank, Afghanistan

Email: *mzennasrudin@unida.gontor.ac.id, icengamal12@gmail.com, fareedmonib@gmail.com,
ahmadsuminto@unida.gontor.ac.id

Abstract

Economic activities are important factors for the development of countries. However, many countries give too much importance to the economy without paying attention to the country's environment as a result of ongoing economic activities, such as industrial, electricity production, transportation, and commercial and residential which can cause environmental degradation with the spread of CO₂ carbon dioxide emissions. The growth of a financial sector that supports those economic activities is considered the driver of carbon emissions at the macro level. However, Islam teaches Muslims to avoid corruption on earth including those leading to the rise in carbon emissions. This makes Muslim-majority countries have better concern in dealing with carbon emissions. This study aims to analyze the influences of financial institution index (FII) and financial market index (FMI) on carbon dioxide emissions in the Organization of Islamic Cooperation member nations. Using the GMM estimator for a panel dataset of 36 countries between 2000 and 2021, this study unravels that the FII significantly increased carbon emissions in OIC countries. In reverse, FMI contributed to the reduction of carbon emissions in OIC countries. This paper recommends the government set regulations for banking sectors to improve eco-friendly credits for the private sector. It is also recommended that the government enrich the issuance of green securities and strengthen the financial market because it is effective in minimizing carbon emissions.

Keywords: Carbon Emissions, financial institution index, financial market index, GMM

Introduction

Boosting a nation's economic growth is essential for development, but environmental protection must become one of the top priorities for consideration during the process. It is necessary since both are global concerns as reflected in Sustainable Development Goals (SDGs), which propose a balanced economic, social, and environmental development. Global warming is one of the challenges the world is facing nowadays in the environmental aspect where the primary cause is carbon dioxide.¹ Trade, production, and use of fossil fuels produce more carbon dioxide, and the environmental sector is undoubtedly threatened by pollution. The main contributors to carbon emissions are five: creating too many products, using too much energy, misusing forests and land, and producing garbage from factories.² An increase in carbon emissions can trigger global warming and rising

¹ Dina Labiba and Wisnu Pradoto, "Sebaran Emisi Co2 dan Implikasinya terhadap Penataan Ruang Area Industri di Kabupaten Kendal," *Jurnal Pengembangan Kota*, Vol. 6, No. 2, (2018), p. 164. <https://doi.org/10.14710/jpk.6.2.164-173>.

² Muhamad Ameer Noor and Putu Mahardika Adi Saputra, "Emisi Karbon dan Produk Domestik Bruto: Investigasi Hipotesis Environmental Kuznets Curve (EKC) pada Negara Berpendapatan Menengah di Kawasan ASEAN," *Jurnal Wilayah dan Lingkungan*, Vol. 8, No. 3, (2020), p. 230–46. <https://>

earth's temperature, so it can change a climate to extremes, with changing weather conditions resulting in winds, storms, and various other natural disasters.

World Bank recorded that in the last two decades, the volume of global carbon emissions has increased by 47.3 percent from 25.45 billion metric tons in 2000 to 37.49 billion metric tons in 2022. Because high levels of carbon dioxide necessitate particular treatment to neutralize carbon dioxide emissions, a higher concentration of carbon dioxide in the atmosphere caused by burning fossil fuels or deforestation can have a major detrimental impact on global warming in the long run.³ One of the efforts or ways to offset these emissions is photosynthesis in plants or trees, which can produce the oxygen humans need.⁴ So the problem arises when the number of available trees cannot neutralize the gas as many people burn forests and reduce trees or forests in a country.

The financial sector is essential in accelerating economic growth. However, it can also harm environmental quality in case there is no regulation for its conservation. In Muslim-majority countries, financial development is accelerating due to the growth of Islamic finance which was started by the United Arab Emirates and Malaysia. Islamic banks grew rapidly and the issuance of sukuk continues to be carried out on a large scale, including the distribution of the first US dollar of 1 million USD, and the presence of Financial Technology facilitates Islamic finance in infrastructure development.⁵ Such financial arrangements have been utilized by many parties to develop the Islamic financial sector, for example, in Indonesia and other Asian Islamic countries.⁶ This raises the question of whether financial development in Muslim countries that have become members of the Organisation of Islamic Cooperation (OIC) has an impact on carbon emissions in those countries. Research on OIC countries is interesting since OIC member states have great power in the financial world, especially in economic growth and international trade.⁷ Asian Development Bank (ADB) in 2011, predicts that two of the few countries that will be the center of the engine for the movement of economic growth in the future are Indonesia and Malaysia, and both are a member of the OIC countries.

Based on income level, 57 OIC countries comprise 6 high-income countries (Qatar, Brunei Darussalam, Uni Emirate Arab, Bahrain, Oman dan Kuwait), 19 as developing countries, and the others as low-income countries.⁸ According to the

doi.org/10.14710/jwl.8.3.230-246.

³ Faris Faza Ghaniyyu and Nurlina Husnita, "Upaya Pengendalian Perubahan Iklim melalui Pembatasan Kendaraan Berbahan Bakar Minyak di Indonesia Berdasarkan Paris Agreement," *MORALITY: Jurnal Ilmu Hukum*, Vol. 7, No. 1, (2021), p. 110. <https://doi.org/10.52947/morality.v7i1.196>.

⁴ Handayani Dewi Rahajoe Joeni Setijo, Alhamd Laode, and Sundari Siti, *Carbon Stock and The Biomassa of Some Agriculture Comodities in The Bodogol, Gunung Gede Pangraro National Park-West Java*, *Jurnal Biologi Indonesia*, Vol. 12, 2016.

⁵ Cupian, Arie Febriyansyah, and Alfiah Hasanah, "Perkembangan Sektor Keuangan Islam dan Pertumbuhan Ekonomi: Studi Empiris Negara OKI," *Al-Tijary: Jurnal Ekonomi dan Bisnis Islam*, Vol. 6, No. 1, (2020), p. 1-15.

⁶ Mosab I. Tabash and Raj S. Dhankar, "Islamic Financial Development and Economic Growth Empirical Evidence from United Arab Emirates," *Journal of Emerging Economies and Islamic Research*, Vol. 2, No. 3, (2014), p. 15. <https://doi.org/10.24191/jeeir.v2i3.9630>.

⁷ Umi Karomah Yaumidin, "Kerjasama Finansial OKI: Isu dan Prospek Kawasan Mata Uang Bersama, Financial Cooperation of OIC Countries," *Ekonomi dan Pembangunan*, Vol. 22, No. 2, (2014), p. 1-15. <https://doi.org/10.14203/JEP.22.2.2014.149-163>

⁸ Khadijah binti Abd Munir, "Respon Organisasi Kerjasama Islam (OKI) terhadap Pelanggaran

Global Islamic Economy Report, the private investment sector increased significantly by \$745 million over the previous three years in 2018. The growth that did not come from the private sector reached a global record of \$595 billion in 2017.⁹ As a result of these developments, it has made positive things for the development of the Islamic financial industry. This financial development opens the door to international trade and free access to global finance, which has a negative impact on the activities mentioned above. Opening cross-border trade, export, and import, restrictions on industry or natural resources. It can cause environmental damage due to the management process, namely increased carbon dioxide pollution.¹⁰ As happened in 1980 the total CO₂ emissions reached 19,324,327 kt, then increased to 22,149,402 kt in 1990, and increased again to 24,489,911 kt in 2000 and then to 33,472,376 kt in 2010. This leads to an increase every year. It also happens that in 2018 carbon emissions grew by 2% to 33,890 million tons due to rapid production and financial developments such as stock market activities, and investments, such activities as investing money which then the funds go to banks and is lent to companies that need funds due to the demand for many goods, and with such activities lead to the consumption of energy fuels such as coal, higher oil and fossil fuels, and the result of such incineration becomes waste that can erode the ozone layer due to smoke and hot steam rising into the air that can cause carbon emissions in a country.¹¹ Every economic activity cannot be separated from negative impacts, there must be one sector that is harmed in these activities.

Several researches have been carried out to investigate the impact of financial development on carbon emissions. The existing studies mostly investigated the determinants of carbon emissions in a group of countries. Financial development has been analyzed as one of the determinants of carbon emission in several studies like those of Jiang & Ma¹², Kwakwa¹³, Rajpurohita & Sharma¹⁴ and Ganda.¹⁵ Nevertheless, their analysis used a single variable to represent overall financial development without detailing the parts that compose the financial development. This study fills the gap through the decomposition of financial development into two different parts in financial development from the financial institution's side and the financial

Hak Asasi Manusia (HAM)," *Jakarta*, (2016).

⁹ Reuters, Thomson, State of the Global Islamic Economy Report 2018/19. 2018 ed. Dubai: Salam Gateway. www.salamgateway.com, 2022.

¹⁰ Kementerian Indonesia, "Bidang Sumber Daya Alam dan Lingkungan Hidup," 2015.

¹¹ Muhammad Madyan, Deni Kusumawardani, and Hasbi Ash Shidiq, "Pengaruh Perkembangan Keuangan terhadap Emisi Co₂ di Indonesia" Vol. 14, No. 2, (2022), p. 167–80. <https://doi.org/10.35313/ekspansi.v14i2.4536>.

¹² Chun Jiang and Xiaoxin Ma, "The Impact of Financial Development on Decarbonization Factors of Carbon Emissions: A Global Perspective," *International Journal of Energy Economics and Policy*, Vol. 11, No. 6, (2021), p. 353–64. <https://doi.org/10.32479/ijeep.11872>.

¹³ Paul Adjei Kwakwa, "The Long-Run Effects of Energy Use, Urbanization and Financial Development on Carbon Dioxide Emissions," *International Journal of Energy Sector Management*, Vol. 14, No. 6, (2020), p. 1405–24. <https://doi.org/10.1108/IJESM-01-2020-0013>.

¹⁴ Surendra Singh Rajpurohit and Rajesh Sharma, "Impact of Economic and Financial Development on Carbon Emissions: Evidence from Emerging Asian Economies," *Management of Environmental Quality: An International Journal*, Vol. 32, No. 2 (2021), p. 145–59. <https://doi.org/10.1108/MEQ-03-2020-0043>.

¹⁵ Fortune Ganda, "The Environmental Impacts of Financial Development in OECD Countries: A Panel GMM Approach," *Environmental Science and Pollution Research*, Vol. 26, No. 7, (2019), p. 6758–72. <https://doi.org/10.1007/s11356-019-04143-z>.

market. This paper aims to reveal the impact of the financial institution index on carbon emissions in OIC countries. Furthermore, it aims to find out the impact of the financial market index on carbon emissions in OIC countries.

Literature Review

Financial Development, Carbon Emission, and Islam

Two groups of scholars view the relationship between financial development and environmental quality, including carbon emission. The first group stated that a solid financial system is effective in reducing carbon emissions. In this case, financial development can contribute to carbon emission mitigation by financing government green project that requires extra funds as a result of the budget constraint.¹⁶ Apart from that, technological upgrades are the benefits of financial development as they will mitigate carbon emission production due to the use of clean energy.¹⁷ Development of the financial market also means high quality of outstanding enterprises listed in the stock market which forces them to keep their image among the financial authorities by increasing their concern for environmental protection like using eco-friendly technologies to reduce carbon emissions.¹⁸

The second group view that financial development is associated with high carbon emissions. They claim that financial development allows enterprises to easily get capital for expansion so they can produce more products, hire more workers, and get more equipment which leads to the rise in carbon emissions.¹⁹ For people, financial development allows them to easily get loans for consumptive purposes which may harm air quality as more harmful commodities for air quality are purchased such as fossil-fuel vehicles, properties, etc.²⁰ Furthermore, good performance of the capital market is often used to represent the prosperity and growth of the economy which gives more confidence to producers and consumers in their production and consumption activities causing more energy consumption and thus carbon emission increases.²¹

According to Islam, human is obligated to keep the environment from corruption (*al-fasaad*) as part of their duty as *Khalifah* on earth.²² Environmental

¹⁶ Muhammad Shahbaz, Aviral Kumar Tiwari, and Muhammad Nasir, "The Effects of Financial Development, Economic Growth, Coal Consumption and Trade Openness on Co2 Emissions in South Africa," *Energy Policy*, 61, (2013), p. 1452–59. <https://doi.org/10.1016/j.enpol.2013.07.006>.

¹⁷ Gürkan Kumbaroğlu, Nihan Karali, and Yıldız Arıkan, "Co2, GDP and RET: An Aggregate Economic Equilibrium Analysis for Turkey," *Energy Policy*, Vol. 36, No. 7, (2008), p. 2694–2708. <https://doi.org/10.1016/j.enpol.2008.03.026>.

¹⁸ Susmita Dasgupta, Benoit Laplante, and Nlandu Mamingi, "Pollution and Capital Markets in Developing Countries," *Journal of Environmental Economics and Management*, Vol. 42, No. 3, (2001), p. 310–35. <https://doi.org/10.1006/jjeem.2000.1161>.

¹⁹ Chun Jiang and Xiaoxin Ma, "The Impact of Financial Development on Carbon Emissions: A Global Perspective," *Sustainability*, Vol. 11, No. 19, (2019), p. 5241. <https://doi.org/10.3390/su11195241>.

²⁰ Yue-Jun Zhang, "The Impact of Financial Development on Carbon Emissions: An Empirical Analysis in China," *Energy Policy*, Vol. 39, No. 4, (2011), p. 2197–2203. <https://doi.org/10.1016/j.enpol.2011.02.026>.

²¹ Faridul Islam et al., "Financial Development and Energy Consumption Nexus in Malaysia: A Multivariate Time Series Analysis," *Economic Modelling*, 30, (2013), p. 435–41. <https://doi.org/10.1016/j.econmod.2012.09.033>.

²² Aziz Gufon, "Islam dan Konservasi Lingkungan (Telaah Pemikiran Fikih Lingkungan Yusuf Al-Qaradhawi)," *Millah*, Vol. 6, No. 2, (2007), p. 55–76. <https://doi.org/10.20885/millah.vol6.iss2.art5>.

protection is also considered a reflection of *maqasid shariah* especially in supporting *hifdzu an-nafs* (protection of life) and *hifdzu an-nasl* (protection of lineage).²³ Based on this teaching, it can be inferred that Muslim-majority countries tend to actualize this Islamic teaching which allows them to maintain their financial development based on environmental protection procedures, and thus carbon emissions may be minimized.

Previous Studies

Chun Jiang and Xiaoxin Ma²⁴ used data from 155 nations using industry-recognized moment systems to analyze the relationship between financial progress and carbon emissions. The sample countries were divided into two subgroups: developed countries and emerging and developing markets, which allowed researchers to study national differences further. However, the results showed that the effect of financial development on carbon emissions is negligible for developed countries. Empirical results show that financial development can significantly increase carbon emissions from a global perspective, and the market analysis of emerging and developing countries reached the same conclusion.

Paul Adjei Kwakwa²⁵ examined the long-term effects of energy sources, urbanization, financial development, urbanization, and economic development on CO₂ emissions. The stochastic influence of regression on population, prosperity, and technical models supports empirical modeling. An autoregressive distributed lag limit test was used to examine the cointegration of variables using annual time series data for Tunisia. Additionally, a fully modified ordinary smallest square is employed to calculate the explanatory variable's emission effect. More research was conducted using the variance decomposition analysis and analysis of the principal components. This study reveals that financial development interaction with urbanization reduced carbon emissions. This study adds to evidence from Tunisia, which hasn't gotten much empirical attention, to the literature on environmental degradation.

Surendra Singh Rajpurohita and Rajesh Sharma²⁶ validated Kuznets' environmental curve for the five Asian nations, examining the effects of additional variables on carbon emissions, including financial development, energy use, and foreign direct investment (FDI). The panel variables of five Asian economies India, Pakistan, Bangladesh, Sri Lanka, and Malaysia for the 35 years between 1980 and 2014 are examined in this study using a pooled mean group approach. The study

²³ Moh Toriquddin, "Teori Maqâshid Syarî'ah Perspektif Al-Syatibi," *De Jure: Jurnal Hukum dan Syar'iah*, Vol. 6, No. 1, (2014). <https://doi.org/10.18860/j-fsh.v6i1.3190>.

²⁴ Chun Jiang and Xiaoxin Ma, "The Impact of Financial Development on Decarbonization Factors of Carbon Emissions: A Global Perspective," *International Journal of Energy Economics and Policy*, Vol. 11, No. 6, (2021), p. 353–64. <https://doi.org/10.32479/ijeeep.11872>.

²⁵ Paul Adjei Kwakwa, "The Long-Run Effects of Energy Use, Urbanization and Financial Development on Carbon Dioxide Emissions," *International Journal of Energy Sector Management*, Vo. 14, No. 6, (2020), p. 1405–24. <https://doi.org/10.1108/IJESM-01-2020-0013>.

²⁶ Surendra Singh Rajpurohit and Rajesh Sharma, "Impact of Economic and Financial Development on Carbon Emissions: Evidence from Emerging Asian Economies," *Management of Environmental Quality: An International Journal*, Vol. 32, No. 2 (2021), p. 145–59. <https://doi.org/10.1108/MEQ-03-2020-0043>.

found that while mild economic growth and financial development raise carbon emissions, fast economic growth and financial development are otherwise. Carbon emissions and energy use were shown to be significantly and directly related. Analysis shows an inverse association between FDI inflows and carbon emissions. On the other hand, FDI inflows linked to financial development are acknowledged to impact carbon emissions directly.

Fortune Ganda²⁷ used static models and a GMM system analysis to look at how financial development impacted the environment in OECD nations from 2001 to 2012. In this context, the research findings demonstrate a negative and significant association between domestic bank loans to the private sector and carbon emissions, greenhouse gases, and sustainability. In contrast, domestic lending to the private sector and economic expansion exhibit favorable and statistically significant relationships with greenhouse gas emissions, sustainability, and carbon emissions. Foreign direct investment has only a favorable and negligible effect on greenhouse gas emissions, but it has a positive and significant association with sustainability and carbon emissions. This investigation adds to the argument that financial institutions should continue implementing more efforts that take the viewpoint of the natural environment.

Zhenghui Li, Hao Dong, Zimei Huang, and Pierre Failler (2019), Impact of Foreign Direct Investment on Environmental Performance²⁸ By creating quantile regression panel patterns, this study sought to understand how foreign direct investment (FDI) affects environmental performance (EP). The quantitative analysis approach is used. Several important points are concluded: First, for complete samples, FDI has little effect on EP. Second, there are differences between developed and developing nations in how FDI affects EP. Furthermore, there is variation in how FDI affects EP at various EP quantiles in developed nations. The effect is statistically negligible on the lower quantile of EP in developed nations. It turns out to be significantly positive on the medium and high quantiles, and the positive effect's strength grows as EP quantiles advance.

Using panel data from 20 Sub-Saharan Africa (SSA) countries, Amoah, Alagidede, and Sare (2023) found a positive relationship between FDI inflows and carbon emissions and a negative relationship between FDI outflows and carbon emissions in the region.²⁹ The authors suggest that governments in the region should implement policies on FDI that aim to reduce carbon emissions. In their paper, they also examine the mediating role of industrialization and the moderating role of trade openness. The empirical results showed that both industrialization and trade openness positively influence FDI and carbon emissions in their respective roles. This means that industrialization and trade openness increase both FDI and

²⁷ Fortune Ganda, "The Environmental Impacts of Financial Development in OECD Countries: A Panel GMM Approach," *Environmental Science and Pollution Research*, Vol. 26, No. 7, (2019), p. 6758–72. <https://doi.org/10.1007/s11356-019-04143-z>.

²⁸ Zhenghui Li, et. al., "Impact of Foreign Direct Investment on Environmental Performance," *Sustainability*, Vol. 11, No. 13, (2019), p. 3538. <https://doi.org/10.3390/su11133538>.

²⁹ Joseph Owusu Amoah, Imhotep Paul Alagidede, and Yakubu Awudu Sare, "Impact of Foreign Direct Investment on Carbon Emission in Sub-Saharan Africa: The Mediating and Moderating Roles of Industrialization and Trade Openness," *Cogent Business & Management*, Vol. 10, No. 3, (2023), p. 2266168. <https://doi.org/10.1080/23311975.2023.2266168>.

carbon emissions in SSA. Their finding with regards to the relationship between FDI and carbon emission is consistent with the findings of Acheampong, Adams & Boateng³⁰ and Mohammad, Kong, Mensah, Antwi, Osei & Donkor³¹ where they found a significant positive relationship between FDI and carbon emission.

An empirical study conducted by Zmami and Salha³² on the determinants of CO₂ emissions in GCC countries shows that, in the long run, energy consumption and FDI have a positive impact on CO₂ emissions, while urbanization has a negative impact. They used the Stochastic Impacts by Regression on Population, Affluence, and Technology (STIRPAT) model for the study. The data covers the period from 1980 to 2017. In the same region, a study conducted by Mahmood³³ covering 1980-2019 found that trade openness helps reduce CO₂ emissions, supporting green economy goals. In the short run, trade openness lowers emissions, but industrialization and urbanization increase them in the long run. To mitigate these environmental impacts, the study suggests increasing trade openness and implementing carbon taxes on industrialization and urbanization.

Using Chudik and Pesaran's (2015) Dynamic Common Correlated Effects (DCCE) approach Ali, *et. al.*³⁴ assessed cross-sectional dependence among unites in OIC countries. Where trade openness, FDI, and institutional performance are used as independent variables and environmental quality as dependent variables. The findings suggest that traditional techniques for long panel data, such as MG and PMG, yield unclear results when cross-sectional dependence exists. DCCE estimation shows that trade openness, FDI, and urbanization have a significant positive impact on the ecological footprint, whereas institutional performance has a significant negative impact. To foster sustainable development and better environmental quality, OIC countries should encourage the adoption of green technology, clean production methods, and improved institutional frameworks. Similarly, using the same model but different data, they examine the impact of trade openness on environmental quality in OIC countries. It reveals that trade openness decreases CO₂, N₂O, and CH₄ emissions while increasing the ecological footprint in overall and higher-income OIC countries. However, in lower-income OIC countries, trade openness raises all environmental indicators. The findings support an inverted-U-shaped Environmental Kuznets Curve (EKC) for CO₂, CH₄, and the ecological

³⁰ Alex O. Acheampong, Samuel Adams, and Elliot Boateng, "Do Globalization and Renewable Energy Contribute to Carbon Emissions Mitigation in Sub-Saharan Africa?," *Science of The Total Environment*, 677 (2019), p. 436–46. <https://doi.org/10.1016/j.scitotenv.2019.04.353>.

³¹ Mohammed Musah, *et. al.*, "Modelling the Connection between Energy Consumption and Carbon Emissions in North Africa: Evidence from Panel Models Robust to Cross-Sectional Dependence and Slope Heterogeneity," *Environment, Development and Sustainability*, Vol. 23, No. 10, (2021), p. 15225–39. <https://doi.org/10.1007/s10668-021-01294-3>.

³² M. Zmami and O. Ben-Salha, "An Empirical Analysis of the Determinants of Co₂ Emissions in GCC Countries," *International Journal of Sustainable Development & World Ecology*, Vol. 27, No. 5, (2020), p. 469–80. <https://doi.org/10.1080/13504509.2020.1715508>.

³³ Haider Mahmood, "Trade Openness, Industrialization, Urbanization and Pollution Emissions in GCC Countries: A Way towards Green and Circular Economies," *International Journal of Energy Economics and Policy*, Vol. 12, No. 2 (2022), p. 309–14. <https://doi.org/10.32479/ijeep.12716>.

³⁴ Sajid Ali, *et. al.*, "Dynamic Common Correlated Effects of Trade Openness, FDI, and Institutional Performance on Environmental Quality: Evidence from OIC Countries," *Environmental Science and Pollution Research*, Vol. 27, No. 11, (2020), p. 11671–82. <https://doi.org/10.1007/s11356-020-07768-7>.

footprint, and a U-shaped EKC for N2O. The study suggests that OIC countries should continue trade openness, implement energy sector reforms, and ensure sustainable biocapacity use to address environmental challenges as income grows.

Farooq et al.³⁵ conducted research examining the effects of globalization and foreign direct investment (FDI) on environmental quality in OIC countries, with a focus on CO2 emissions. Utilizing the GMM technique to address endogeneity issues, reveals that globalization and FDI raise CO2 emissions and degrade environmental quality in overall and low-income OIC countries, while they reduce CO2 emissions in high-income OIC countries. Moreover, institutional quality, urbanization, and industrialization have significant impacts on CO2 emissions across all OIC countries. The study concludes that while globalization and FDI can enhance environmental quality in high-income OIC states, they deteriorate it in others, indicating the need for careful management to reduce carbon emissions.

Methodology

This research used panel data from 36 OIC countries spanning from 2000 to 2021. The other OIC countries are excluded due to the availability issue of the data. The dependent variable is carbon emission (*CARBON*) while the independent variables are the financial institution index (*FII*), financial institution index (*FMI*), foreign direct investment (FDI), and globalization (*TRADE*). *FII* represents the size, liquidity, accessibility, and efficiency of financial institutions like banks while *FMI* represents the size, liquidity, accessibility, and efficiency of the financial market, especially the capital market. Table 1 shows the operational variables’ definitions and their data sources comprising ourworldindata.org and the International Monetary Fund (IMF). The basic estimation model is formulated as follows:

$$CARBON_{it} = \alpha + \beta_1 FII_{it} + \beta_2 FMI_{it} + \beta_3 FDI_{it} + \beta_4 TRADE_{it} + e_{it}$$

Table 1. Operational Variable Definition

Variable	Definition	Unit Adopted	Source
<i>CARBON</i>	Carbon dioxide emissions per capita	Ton per capita	Ourworldindata.org
<i>FII</i>	Financial Institution Index	Index (0.00 – 1)	IMF
<i>FMI</i>	Financial Market Index	Index (0.00 – 1)	IMF
<i>FDI</i>	Net inflows of foreign direct investment (FDI) share of GDP	%	IMF
<i>TRADE</i>	International trade share of GDP	%	Ourworldindata.org

This paper used the Generalized Method of Moments (GMM) following Sun, et. al.³⁶ and Fajri, et. al.³⁷ GMM is the proper method to use in this study because it is

³⁵ Farooq, Fatima, et. al., “How Do Globalization and Foreign Direct Investment Affect Environmental Quality in OIC Member Countries?,” *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, Vol. 14, No. 2, (2020), p. 551–68.

³⁶ Xiaomin Sun, et. al., “Exploring the Complex Nexus between Sustainable Development and Green Tourism through Advanced GMM Analysis,” *Sustainability*, Vol. 15, No. 14, (2023), p. 10782. <https://doi.org/10.3390/su151410782>.

³⁷ Mohammad Zen Nasrudin Fajri, et. al., “The Impact of MSMEs Financing in Islamic Bank on Unemployment in Indonesia,” *Jurnal Ekonomi Syariah Teori dan Terapan*, Vol. 10, No. 5, (2023), p. 443–54. <https://doi.org/10.20473/vol10iss20235pp443-454>.

effective in avoiding several obstacles encountered during panel data estimation such as serial correlation, omitted variable bias, and endogeneity issues. In Fixed Effect Model (FEM) and Random Effect Model (REM), endogeneity cannot be resolved while unobserved heterogeneity cannot be controlled.

The analysis starts by conducting a stationarity test for all variables. Afterward, estimation results from the CEM, FEM, and REM are displayed to compare the results based on their coefficient of determination. The Chow test is then conducted to select the best model between CEM and FEM followed by the Hausmen test which is used to select the best model between FEM and REM. The selection step ends when the two tests show that FEM is the best among the three models, otherwise, the LM test is conducted to select between CEM and REM. After ensuring FEM is the best model among them, GMM estimation is then conducted. The analysis ends with the Sargan test to check the validity of instruments used in GMM.

Results and Discussion

Descriptive Statistics

The data mentioned above on carbon emissions, financial institution index, financial market index, foreign direct investment, and globalization is processed using EViews, and descriptive statistics of the data are shown in table 2. It can be seen that the sum of the data for all the variables is 729. The average value of variable carbon emission is 5.516040 tons per capita, with the lowest value of 0.046717 tons per capita and a maximum value of 67.49374. The value of the financial institution index ranges from 0.062402 to 0.714251, with an average value of 0.277985. The value of the financial market index ranges from 5.66E-11 to 0.739383, with an average value of 0.159025. The average value of variable FDI is 39.29672 %, with a low weight of 0.0114 % and a maximum weight of 32.30120%. The Globalization variable ranges from 4.127549 as its least value to 220.4068 as its largest value, with an average value of 69.30116.

Table 2. Results of Descriptive Statistical Analysis

Variables	Obs	Mean	Median	Maximum	Minimum	Std. Deviation
<i>CARBON</i>	729	5.516040	1.718853	67.49374	0.046717	9.489698
<i>FII</i>	729	0.277985	0.246659	0.714251	0.062402	0.126820
<i>FMI</i>	729	0.159025	0.051499	0.739383	5.66E-11	0.198271
<i>FDI</i>	729	39.29672	6.346718	32.30120	0.000114	190.1656
<i>TRADE</i>	729	69.30116	62.79135	220.4068	4.127549	32.09722

Results

Table 2 shows the results of unit root tests employing Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests. Foreign direct investment is the only variable that has stationer data in both ADF and PP tests because the value is 0.0000 rejecting the null hypothesis. Meanwhile, the results show that the other variables are either their data non-stationer at all or stationer in one of the two tests. Based on these results, log transformation is needed for those variables.

Table 3. Stationarity Tests

Variables	Probability Value	
	ADF	PP
CARBON	0.5049	0.2539
FII	0.4014	0.0619*
FMI	0.3783	0.4577
FDI	0.0000***	0.0000***
TRADE	0.1591	0.0943*

*** and * denote a significance level of 1% and 10% respectively

Following that, the estimation results from the three models are displayed in Table 4. It shows that the CEM's F-statistical value is 349.9486, its R-square value is 0.640112, and its Prob (F-statistic) value is 0.0000. The FEM estimation result's R-square value is 0.987079, and its statistical F value is 1473.076 while Prob (F-statistic) value is 0.0000. Meanwhile, the REM estimate result's R-square value is 0.188654, and its statistical F value is 45.74812 while the Prob (F-statistic) value is 0.0000. Hence, considering the R-Square, FEM shows the highest relationship between dependent and independent variables.

Table 4. The Estimation Results of CEM, FEM and REM

Variable	Coefficient/ Probability Value		
	CEM	FEM	REM
LOG(FII)	2.018272 [0.0000***]	0.579599 [0.0000***]	0.611995 [0.0000***]
LOG(FMI)	0.14332 [0.0000***]	-0.004512 [0.342]	-0.002474 [0.6012]
LOG(FDI)	-0.020729 [0.2659]	0.009064 [0.0467**]	0.008145 [0.0734*]
LOG(TRADE)	1.071218 [0.0000***]	0.059856 [0.1214]	0.078254 [0.0421**]
R-Square	0.640112	0.987079	0.188654
F-Statistic	349.9486	1473.076	45.74812
Prob (F-Statistic) value	0.0000***	0.0000***	0.0000***
Chow Test	p-value = 0.0000		
Hausman Test	P > Chi2 = 0.0000		

***, **, * denote a significance level of 1%, 5%, 10% respectively

The same table shows the results of model selection using the Chow test and Hausman test. The result of the Chow test shows that the probability value is 0.0000 and therefore the null hypothesis is rejected. This implies that FEM is selected as the best model instead of CEM. Likewise, The result of the Hausman test shows that the probability chi-squared value is 0.0000, and therefore the null hypothesis is rejected. It also means that FEM is selected as the best model instead of REM. Since both tests show that FEM is the best model, the estimation result of FEM is selected to show the result of analysis in this paper.

Table 5. GMM Estimation Results

Variables	Coefficient	Std. Error	t-Statistic	Prob.
<i>LOG(CARBON(-1))</i>	0.904508	0.009747	92.79845	0.0000***
<i>LOG(FII)</i>	0.04501	0.008579	5.246646	0.0000***
<i>LOG(FMI)</i>	-0.008576	0.002928	-2.92881	0.0035***
<i>LOG(FDI)</i>	0.009473	0.001953	4.849063	0.0000***
<i>LOG(TRADE)</i>	-0.02804	0.012191	-2.30004	0.0217**
Sargan Test:				
Chi-Square	34.051			
P > Chi2	0.3228			

*** and ** denote a significance level of 1% and 5% respectively

After confirming that FEM is the best model, GMM estimation was conducted. Table 5 shows GMM estimation results indicating that the t-statistical value of *LOG(FII)* is 5.246646 with a positive direction and its probability value is 0.0000 or less than 0.05. Therefore, it can be said that the financial institution index significantly and positively affects the amount of carbon emissions. The coefficient value of 0.04501 implies that a 1% increase in FII raised carbon emissions by 0.04501%. On the other hand, *LOG(FMI)* t-statistical value is -2.92881 with a negative sign with a significance value of 0.0000. This indicates that the financial market index significantly reduces the amount of carbon emissions. The coefficient value of -0.008576 means that carbon emissions were reduced by 0.008576% for every 1% increase in FMI.

Meanwhile, the t-statistical value of *LOG(FDI)* is 4.849063 with a positive direction and its probability value is 0.0000 or less than 0.05. Therefore, it can be said that foreign direct investment significantly and positively affects the amount of carbon emissions. The coefficient value of 0.009473 implies that a 1% increase in FDI raised carbon emissions by 0.009473%. On the other hand, *LOG(TRADE)* t-statistical value is -2.30004 with a negative sign with a significance value of 0.0000. This indicates that globalization significantly reduces the amount of carbon emissions. The coefficient value of -0.02804 means that carbon emissions were reduced by 0.02804% for every 1% increase in globalization.

The results of the Sargan test show that the probability Chi-squared value is 0.3228 or less than 0.05 accepting the null hypothesis. This implies that over-identifying instruments in the results are valid.

Discussion

The Effect of Financial Institution Index on Carbon Emissions in OIC Countries

The financial sector is the most important in every nation. The financial sector comprises various industries, including banking, insurance, financing, and securities. This sector is the heart of a country because it is in this sector that the center where the flow of money rotates. When the economy grows, the industry gains development and profit. However, the impact or consequences of financial products will undoubtedly increase excessive economic activities that can harm a country's environmental sector as a result of these activities.³⁸ Especially in the corporate and industrial sectors that can affect the spread of carbon dioxide emissions.

³⁸ Ita Rustiati Ridwan, "Dampak Industri terhadap Lingkungan dan Sosial," *Jurnal Geografi Gea*, Vol. 7, No. 2, (2016). <https://doi.org/10.17509/gea.v7i2.1716>.

The findings show that a 1% increase in the financial institution index raised carbon emissions by 0.04501%. This implies that better size, liquidity, accessibility, and efficiency of the financial institution have increased carbon emissions in OIC countries. The results of this study support Jiang & Ma's³⁹ findings when investigating developed and developing countries. Rajpurohit & Sharma⁴⁰ explained that a moderate development of the financial sector is the cause of high carbon emissions which is in line with the trend in OIC countries. Furthermore, the large size of banks with easy access to credit tends to encourage people to be consumptive which may lead to environmental degradation such as easy loans for purchasing fossil-fuel vehicles and properties.⁴¹

The Effect of Financial Market Index on Carbon Emissions in OIC Countries

The findings show that carbon emissions were reduced by 0.008576% for every 1% increase in the financial market index. This shows that better size, liquidity, accessibility, and efficiency of the financial market have reduced carbon emissions in OIC countries. The results of this study support Kwakwa's⁴² findings that financial development interaction with urbanization reduced carbon emissions in Tunisia and Habiba & Xnbang's⁴³ findings that a good performance of the financial market reduces carbon emissions in developed and developing countries.

Such an impact in OIC countries can be explained by the growth of green products in the capital market in recent years like green bonds, green sukuk, etc. Dasgupta et al⁴⁴ further explains that a strong financial market makes the enterprises listed in the stock market keep their image before the public by supporting environmental conservation which then leads to carbon emission reduction. The growth of green sukuk in OIC countries may become the main contributor to this impact. It also shows that people in OIC countries develop financial market sectors within the Islamic values, implementing *maqasid syariah* consisting of *hifdzu an-nafs* and *hifdzu an-nasl*.

The Effect of Foreign Investment on Carbon Emissions in OIC Countries

A country's foreign investment activity that brings cash flows and enriches the economy is known as foreign direct investment (FDI). Promoting the transfer of managerial expertise and new technology from capital-owning nations to capital-receiving nations so that the presence of foreign direct investment (FDI) can contribute

³⁹ Jiang and Ma, "The Impact of Financial Development on Decarbonization Factors of Carbon Emissions: A Global Perspective."

⁴⁰ Surendra Singh Rajpurohit and Rajesh Sharma, "Impact of Economic and Financial Development on Carbon Emissions: Evidence from Emerging Asian Economies," *Management of Environmental Quality: An International Journal*, Vol. 32, No. 2, (2020), p. 145–59. <https://doi.org/10.1108/MEQ-03-2020-0043>.

⁴¹ Zhang, "The Impact of Financial Development on Carbon Emissions."

⁴² Kwakwa, "The Long-Run Effects of Energy Use, Urbanization and Financial Development on Carbon Dioxide Emissions."

⁴³ Umme Habiba and Cao Xinbang, "The Impact of Financial Development on Co2 Emissions: New Evidence from Developed and Emerging Countries," *Environmental Science and Pollution Research*, Vol. 29, No. 21 (2022), p. 31453–66. <https://doi.org/10.1007/s11356-022-18533-3>.

⁴⁴ Dasgupta, Laplante, and Mamingi, "Pollution and Capital Markets in Developing Countries."

to the acceleration of sustainable economic growth.⁴⁵ Foreign investment activities can also create a factory that can produce more goods and market at low prices. In addition, it can cause social and environmental impacts around factories owned by foreign parties. All these activities forget about one sector that is threatened due to waste generated from factory activities during its production period and provoking carbon emissions

Based on the findings, when foreign direct investment rises by 1%, the spread of carbon emissions increases by 0.009473%. The results of this study support the claim that the amount of foreign direct investment (FDI) activities directly correlates with the degree of carbon dioxide emissions distribution. This is so that different countries' energy efficiency and diversification strategies can be better coordinated to reduce carbon emission pollution. These policies concern the entry of FDI operations. This study's findings are in line with those of Zhenghui Li and Hao Dong's earlier research⁴⁶ and Fortune Ganda.⁴⁷ It asserted that foreign direct investment had a positive and considerable impact on the rise of carbon dioxide emissions (FDI).

The Effect of Globalization on Carbon Emissions in OIC Countries

Globalization is a process of world economic activity involving various countries. A country can be said to be globalized in terms of international trade (exports, imports) and increase in its market size involving several countries making the country experience globalization. Globalization can also be characterized by eroding the flow or limitation of economic activities, increasingly becoming one or global, involving many countries. Globalization activities such as trade, investment, finance, and production must undoubtedly be considered, one of which is that the industrial world can cause problems in a country due to the operational activities of the industry. With this, globalization is the next threat to a country's environment by increasing carbon dioxide emissions from all activities that liberate international trade.

The findings of the study show that a 1% rise in globalization leads to a 0.02804% decrease in carbon emissions. These findings strengthen what Mahmud found when investigating GCC countries and Kaliappan in OIC countries. This is due to potential connections between global trade and the environment. Free trade activities can also cause carbon emissions, but there are certainly advantages of free marketing that can promote development and preserve the environment.⁴⁸

Conclusion

Financial development is crucial for a country since it is considered a fuel for development in real sectors which then increases economic growth and prosperity of the people. However, it is worth noting that such a development can harm the

⁴⁵ Amoah, Alagidede, and Sare, "Impact of Foreign Direct Investment on Carbon Emission in Sub-Saharan Africa."

⁴⁶ Zhenghui Li, *et. al.*, "Impact of Foreign Direct Investment on Environmental Performance," 2019, p. 1-16.

⁴⁷ *Ibid.*

⁴⁸ Kevin P. Gallagher, "Economic Globalization and the Environment," *Annual Review of Environment and Resources*, 44, (2019), p. 373-98. <https://doi.org/10.1146/annurev-environ-102016-060839>.

environment in case of no proper control over it. This study reveals that the size, liquidity, accessibility, and efficiency of financial institutions increase carbon emissions in OIC countries while those of financial markets reduce carbon emissions in OIC countries.

The findings of this study suggest the government to set some regulations for banking sectors to enrich eco-friendly financing so that people or the private sector can contribute to environmental conservation while applying for loans. It also recommended that the government expand the issuance of green securities and strengthen the financial market to minimize carbon emissions in the country.

References

- Acheampong, Alex O., Samuel Adams, and Elliot Boateng. "Do Globalization and Renewable Energy Contribute to Carbon Emissions Mitigation in Sub-Saharan Africa?" *Science of the Total Environment*. 677, (2019). <https://doi.org/10.1016/j.scitotenv.2019.04.353>.
- Ali, Sajid, Zulkornain Yusop, Shivee Ranjane Kaliappan, and Lee Chin. "Dynamic Common Correlated Effects of Trade Openness, FDI, and Institutional Performance on Environmental Quality: Evidence from OIC Countries." *Environmental Science and Pollution Research*. Vol. 27, No. 11, (2020). <https://doi.org/10.1007/s11356-020-07768-7>.
- Amoah, Joseph Owusu, Imhotep Paul Alagidede, and Yakubu Awudu Sare. "Impact of Foreign Direct Investment on Carbon Emission in Sub-Saharan Africa: The Mediating and Moderating Roles of Industrialization and Trade Openness." *Cogent Business & Management*. Vol. 10, No. 3, (2023). <https://doi.org/10.1080/23311975.2023.2266168>.
- Cupian, Arie Febriyansyah, and Alfiah Hasanah. "Perkembangan Sektor Keuangan Islam dan Pertumbuhan Ekonomi: Studi Empiris Negara OKI." *Al-Tijary: Jurnal Ekonomi dan Bisnis Islam*. Vol. 6, No. 1, (2020).
- Dasgupta, Susmita, Benoit Laplante, and Nlandu Mamingi. "Pollution and Capital Markets in Developing Countries." *Journal of Environmental Economics and Management*. Vol. 42, No. 3, (2001). <https://doi.org/10.1006/jeem.2000.1161>.
- Farooq, Fatima, Imran Sharif Chaudhry, Zulkornain Yusop, and Muzafar Shah Habibullah. "How Do Globalization and Foreign Direct Investment Affect Environmental Quality in OIC Member Countries?" *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, Vol. 14, No. 2, (2020).
- Gallagher, Kevin P. "Economic Globalization and the Environment." *Annual Review of Environment and Resources*, 44, (2019). <https://doi.org/10.1146/annurev-environ-102016-060839>.
- Ganda, Fortune. "The Environmental Impacts of Financial Development in OECD Countries: A Panel GMM Approach." *Environmental Science and Pollution Research*. Vol. 26, No. 7 (2019). <https://doi.org/10.1007/s11356-019-04143-z>.
- Ghaniyyu, Faris Faza, and Nurlina Husnita. "Upaya Pengendalian Perubahan Iklim melalui Pembatasan Kendaraan Berbahan Bakar Minyak di Indonesia Berdasarkan Paris Agreement." *MORALITY: Jurnal Ilmu Hukum*. Vol. 7, No. 1, (2021) <https://doi.org/10.52947/morality.v7i1.196>.
- Gufron, Aziz. "Islam dan Konservasi Lingkungan (Telaah Pemikiran Fikih Lingkungan Yusuf Al-Qaradhawi)." *Millah*. Vol. 6, No. 2, (2007). <https://doi.org/10.20885/>

millah.vol6.iss2.art5.

- Habiba, Umme, and Cao Xinbang. "The Impact of Financial Development on CO₂ Emissions: New Evidence from Developed and Emerging Countries." *Environmental Science and Pollution Research*. Vol. 29, No. 21, (2022). <https://doi.org/10.1007/s11356-022-18533-3>.
- Islam, Faridul, Muhammad Shahbaz, Ashraf U. Ahmed, and Md. Mahmudul Alam. "Financial Development and Energy Consumption Nexus in Malaysia: A Multivariate Time Series Analysis." *Economic Modelling*. 30 (2013). <https://doi.org/10.1016/j.econmod.2012.09.033>.
- Indonesia, Kementerian. "Bidang Sumberdaya Alam dan Lingkungan Hidup," 2015.
- Jiang, Chun, and Xiaoxin Ma. "The Impact of Financial Development on Decarbonization Factors of Carbon Emissions: A Global Perspective." *International Journal of Energy Economics and Policy*. Vol. 11, No. 6, (2021). <https://doi.org/10.32479/ijeep.11872>.
- Kwakwa, Paul Adjei. "The Long-Run Effects of Energy Use, Urbanization and Financial Development on Carbon Dioxide Emissions." *International Journal of Energy Sector Management*. Vol. 14, No. 6, (2020). <https://doi.org/10.1108/IJESM-01-2020-0013>.
- Labiba, Dina, and Wisnu Pradoto. "Sebaran Emisi Co₂ dan Implikasinya terhadap Penataan Ruang Area Industri di Kabupaten Kendal." *Jurnal Pengembangan Kota*. Vol. 6, No. 2, (2018). <https://doi.org/10.14710/jpk.6.2.164-173>.
- Li, Zhenghui, Hao Dong, Zimei Huang, and Pierre Failleur. "Impact of Foreign Direct Investment on Environmental Performance," 2019.
- _____. "Impact of Foreign Direct Investment on Environmental Performance." *Sustainability*. Vol. 11, No. 13 (2019). <https://doi.org/10.3390/su11133538>.
- Madyan, Muhammad, Deni Kusumawardani, and Hasbi Ash Shidiq. "Pengaruh Perkembangan Keuangan terhadap Emisi Co₂ di Indonesia". Vol. 14, No. 2, (2022). <https://doi.org/10.35313/ekspansi.v14i2.4536>.
- Mahmood, Haider. "Trade Openness, Industrialization, Urbanization and Pollution Emissions in GCC Countries: A Way towards Green and Circular Economies." *International Journal of Energy Economics and Policy*. Vol. 12, No. 2, (2022). <https://doi.org/10.32479/ijeep.12716>.
- Mohammad Zen Nasrudin Fajri, Azidni Rofiqo, Abdul Latif Rizqon, and Raditya Hasan. "The Impact of MSMEs Financing in Islamic Bank on Unemployment in Indonesia." *Jurnal Ekonomi Syariah Teori dan Terapan*. Vol. 10, No. 5, (2023). <https://doi.org/10.20473/vol10iss20235pp443-454>.
- Munir, Khadijah binti Abd. "Respon Organisasi Kerjasama Islam (OKI) terhadap Pelanggaran Hak Asasi Manusia (HAM)." *Jakarta*, 2016.
- Musah, Mohammed, Yusheng Kong, Isaac Adjei Mensah, Stephen Kwadwo Antwi, Agyemang Andrew Osei, and Mary Donkor. "Modelling the Connection between Energy Consumption and Carbon Emissions in North Africa: Evidence from Panel Models Robust to Cross-Sectional Dependence and Slope Heterogeneity." *Environment, Development and Sustainability*. Vol. 23, No. 10, (2021). <https://doi.org/10.1007/s10668-021-01294-3>.
- Noor, Muhamad Ameer, and Putu Mahardika Adi Saputra. "Emisi Karbon dan Produk Domestik Bruto: Investigasi Hipotesis Environmental Kuznets Curve (EKC) pada Negara Berpendapatan Menengah di Kawasan ASEAN." *Jurnal Wilayah dan Lingkungan*. Vol. 8, No. 3, (2020). <https://doi.org/10.14710/jwl.8.3.230-246>.

- Rahajoe Joeni Setijo, Alhamd Laode, Sundari Siti, Handayani Dewi. *Carbon Stock and The Biomassa of Some Agriculture Commodities in The Bodogol, Gunung Gede Pangraro National Park-West Java. Jurnal Biologi Indonesia*. Vol. 12, 2016.
- Rajpurohit, Surendra Singh, and Rajesh Sharma. "Impact of Economic and Financial Development on Carbon Emissions: Evidence from Emerging Asian Economies." *Management of Environmental Quality: An International Journal*. Vol. 32, No. 2, (2020). <https://doi.org/10.1108/MEQ-03-2020-0043>.
- Ridwan, Ita Rustiati. "Dampak Industri terhadap Lingkungan dan Sosial." *Jurnal Geografi Gea*. Vol. 7, No. 2, (2016). <https://doi.org/10.17509/gea.v7i2.1716>.
- Shahbaz, Muhammad, Aviral Kumar Tiwari, and Muhammad Nasir. "The Effects of Financial Development, Economic Growth, Coal Consumption and Trade Openness on CO2 Emissions in South Africa." *Energy Policy*. 61 (2013). <https://doi.org/10.1016/j.enpol.2013.07.006>.
- Shahbaz, Muhammad, Aviral Kumar Tiwari, and Muhammad Nasir. "The Effects of Financial Development, Economic Growth, Coal Consumption and Trade Openness on CO2 Emissions in South Africa." *Energy Policy*. 61 (2013). <https://doi.org/10.1016/j.enpol.2013.07.006>.
- Sun, Xiaomin, Jing Qing, Syed Ahsan Ali Shah, and Yasir Ahmed Solangi. "Exploring the Complex Nexus between Sustainable Development and Green Tourism through Advanced GMM Analysis." *Sustainability*. Vol. 15, No. 14, (2023). <https://doi.org/10.3390/su151410782>.
- Tabash, Mosab I., and Raj S. Dhankar. "Islamic Financial Development and Economic Growth Empirical Evidence from United Arab Emirates." *Journal of Emerging Economies and Islamic Research*. Vol. 2, No. 3, (2014). <https://doi.org/10.24191/jeeir.v2i3.9630>.
- Toriquddin, Moh. "Teori Maqâshid Syarî'ah Perspektif Al-Syatibi." *De Jure: Jurnal Hukum dan Syar'iah*. Vol. 6, No. 1, (2014). <https://doi.org/10.18860/j-fsh.v6i1.3190>.
- Yaumidin, Umi Karomah. "Kerjasama Finansial OKI: Isu dan Prospek Kawasan Mata Uang Bersama, Financial Cooperation of OIC Countries." *Ekonomi dan Pembangunan*. Vol. 22, No. 2, (2014).
- Zhang, Yue-Jun. "The Impact of Financial Development on Carbon Emissions: An Empirical Analysis in China." *Energy Policy*. Vol. 39, No. 4, (2011). <https://doi.org/10.1016/j.enpol.2011.02.026>.
- Zmami, M., and O. Ben-Salha. "An Empirical Analysis of the Determinants of Co2 Emissions in GCC Countries." *International Journal of Sustainable Development & World Ecology*. Vol. 27, No. 5, (2020). <https://doi.org/10.1080/13504509.2020.1715508>.