

**This is an accepted author manuscript. The final version of the paper is available at:**

<https://www.sciencedirect.com/science/article/pii/S2214845022001065>

## **Shari'ah compliance and environmental performance - Evidence from the USA**

Rashedul Hasan<sup>1</sup>, PhD, ACMA, CGMA

School of Economics, Finance and Accounting, Coventry University, United Kingdom

Email: [ad6284@coventry.ac.uk](mailto:ad6284@coventry.ac.uk)

### **Abstract**

The United Nations labelled climate change as one of the greatest challenges of all time. The least developed countries could suffer more from the adverse impact of climate change and require financial support from the advanced economies to combat such a global challenge. However, advanced economies are falling short of their pledges to provide financial support to emerging economies under Paris Agreement. Therefore, this study explores the environmental performance of firms listed in the US stock market to explore the current trends in environmental performance. We explore the environmental performance of US-listed non-financial firms under the theoretical lens of Maqasid Shariah. Maqasid Shariah has environmental sustainability embedded within its core values and could guide firms to become more environmentally friendly. This study collects secondary data from REFINITIV databases for four hundred eighty-one non-financial firms listed on the US stock exchange. This study covers a period of five years (2017-2021) and uses an unbalanced panel with 1,860 observations. The least-square dummy variable results confirm that Shari'ah-compliant firms have better environmental performance. Such results hold after endogeneity corrected regression. The study findings have practical implications for regulators and promote the role of ethical business models toward mitigating the challenges of climate change. This is unique as it presents empirical evidence of the positive association between Shari'ah compliance and environmental performance in the context of an advanced economy.

Keywords: Shari'ah, climate change, environmental performance, endogeneity, USA

JEL Codes: Q54, Q56

---

<sup>1</sup> Corresponding author can be contacted at [ad6284@coventry.ac.uk](mailto:ad6284@coventry.ac.uk).

## **1. Introduction**

The 2030 Agenda for Sustainability Development in paragraph 14 indicate climate change as “one of the greatest challenges of our time” (United Nations, 2022). The United Nations Sustainable Development Goal 13 recommends all countries take necessary actions for this global challenge of climate change which might have a severe impact on the least developed countries. While developed countries pledge to provide necessary financial assistance to least developed countries to mitigate climate change, the Conference of Parties (COP) 15 and 19 revealed that developed countries failed short of such a pledge (United Nations, 2022). Among the G7 countries, the United States has been a leader in terms of various policy initiatives to mitigate climate change. President Biden has formed the first-ever National Climate Task Force and adopted several goals of reaching a carbon-neutral economy by 2035 (National Climate task Force, 2022).

We have several rationales for exploring environmental performance from the US context. The United States is the second largest emitter of CO<sub>2</sub> after China (Our World in Data, 2017). As such, we have a plethora of past studies exploring various aspects of CO<sub>2</sub> emission from the US (Tiwari, et al., 2021; Zhang, et al., 2017) and China (Du, et al., 2017) in recent years. However, only recently, CO<sub>2</sub> emission has been examined from an ethical lens (Antonakakis, et al., 2017). There is limited empirical evidence available on CO<sub>2</sub> emission from an Islamic worldview from the US context as most of the current evidence covers Islamic financial institutions from emerging countries (Jan, et al., 2019).

While there is evidence of environmental performance for US-listed firms (Cui, et al., 2016; Cong & Freedman, 2011; Post, et al., 2015), the current study is unique as it provides a comparison of environmental performance between Shari’ah compliant and non-compliant firms. Such evidence is rare in past literature. The rationale for exploring environmental performance from the theoretical framework of an Islamic worldwide is due to the ethical business model embedded in the Maqasid Shari’ah. There is evidence of a positive association between Shari’ah compliance and environmental performance. However, limited or no evidence exists from the perspective of Shari’ah-compliant firms operating in developed countries. As such, the findings of the current study make unique contributions to the existing literature on both Shari’ah compliance and environmental performance.

The current study uses data collected from the REFINITIV database for firms listed on the United States stock exchange. Four different proxies have been used to measure environmental performance. Shari’ah compliance of firms has been identified from the

REVIBITIV database. The empirical results confirm that Shari'ah-compliant firms have better environmental performance. The results hold after controlling for endogeneity problems identified by performing three independent checks. The rest of the paper is divided into five sections: section 1 introduces the topic, section 2 critically reviews the literature, section 3 discusses the methodological issues, section 4 presents the results and section 5 concludes the study with practical implications.

## **2. Literature review and hypothesis development**

Several studies have explored the environmental performance of financial firms. Campisi et al. (2018), for example, identify the effectiveness of various Shari'ah-compliant investment instruments to promote a green economy in Italy. The case study approach adopted by Campisi et al. (2018) allows them to conclude that Sukuk can play become a financing source for sustainable investments. There is a growing trend in the academic to explore the suitability of Sukuk as a financing source for sustainable projects (Ashraf, et al., 2021; Ashraf, et al., 2022; Uluyol, 2021; Meo & Abd Karim, 2022).

A plethora of past studies explores corporate social responsibility initiatives of Shari'ah-compliant firms (Ameraldo & Ghazali, 2021; Arsad, et al., 2015; Mallin, et al., 2014). Ameraldo and Ghazali (2021) provide evidence that leverage influences Shari'ah-compliant companies' environmental disclosure. Ameraldo and Ghazali (2021) extract samples from the Shari'ah stock index in Indonesia, therefore, limiting an opportunity to compare CSR (Corporate Social Responsibility) disclosure between Shari'ah-compliant and non-compliant firms. Another limitation of past studies focusing on CSR disclosure is that environmental issues do not receive proper attention. For example, the CSR index of Ameraldo and Ghazali (2021) only includes two environmental items (use of resources, pollution, and environmental protection program) out of 33 items available in the index.

The rationale for not reviewing CSR-focused studies in the current study is two-fold. First, corporate social responsibility (CSR) is a broad term and covers a segment of environmental issues. As such, the findings from the studies focusing primarily on CSR may not be relevant to the current study that focuses on environmental performance. Second, past studies explore CSR from a disclosure perspective, meaning authors investigate the CSR disclosure of Shari'ah-compliant firms (Ameraldo & Ghazali, 2021; Mallin, et al., 2014). Mallin et al. (2014) adapted the CSR index of Maali et al. (2006) which includes only two environmental issues (donations to environmental projects and bank finance that lead to harming the environment). As such, past studies presenting CSR disclosure of Shari'ah-

compliant firms do not provide complete evidence of environmental performance. Mallin et al. (2014) identify that majority of the past studies focus on Islamic banks when discussing the issues related to Shari'ah compliance and CSR disclosure.

However, this study does not consider financial firms simply because they do not contribute a huge amount of environmental pollution (Ritchie & Roser, 2020). Financial firms could promote a green economy by implementing environmental risk screening in their project financing decision. The equator principles (Scholtens & Dam, 2007) has been a unique initiative that requires adopters to apply additional environmental screening during project financing decisions. Scholtens and Dam (2007) do not present different findings in terms of environmental performance between adopters and non-adopters. Considering the equator principle is developed for the financial sector, it is inappropriate to generalize such findings for non-financial firms.

. There are a limited number of studies available that focuses on the nexus between Shari'ah compliance and environmental performance. Erragragui and Revelli (2016) report no adverse effect on return due to the application of ESG screens on Shari'ah-compliant stocks. Erragragui and Revelli (2016) further confirm that Islamic portfolio managers can take advantage of the governance premium under the lens of business ethics theory and financial theory. While Erragragui and Revelli (2016) focus on the US stock market, more specifically the MSCI (Morgan Stanley Capital International) US Islamic Index, the current study is unique as it focuses on the environmental performance of individual Shari'ah complaint firms listed on the US stock exchange.

The current study is based on the principles of Shari'ah (Maqasid Shari'ah) following Yaakub and Abdullah (2020). Maqasid Shari'ah provides clear guidance to identify Shari'ah-compliant firms based on their business activities. Also, the Maqasid Shari'ah provides a clear indication to Shari'ah-compliant firms on the need to preserve environmental sustainability. We refer to the Theoretical Framework of Maqasid Shari'ah (Oladapo & Rahman, 2016) which categorizes human needs into three levels: essential, complementary and embellishment. Under the essential element of human needs, the Maqasid guides the need to preserve the environment with clear reference from Quran (the Holy Book) and Sunnah (Teaching from the Prophet Muhammad (*Peace be upon him*)).

Yaakub and Abdullah (2020) conclude that Shari'ah-compliant firms (following Maqasid Shariah) can successfully improve air quality. Al Haq and Abd Wahab (2019) make a clear link between Shari'ah compliance and the sustainability paradigm. Miftahorrozi, et al. (2022) also reach similar conclusions. While past studies provide evidence in the context of

developing countries, there is limited evidence from Shari'ah-compliant firms operating in developed countries. Therefore, this study develops the following hypothesis to investigate whether Shari'ah-compliant firms in developed countries have better environmental performance:

*H<sub>1</sub>: Ceteris Paribus, Shariah-compliant firms have better environmental performance.*

### **3. Methodology**

In the current study, the following equation is used to study the above hypothesis:

$$\text{Environmental performance}_{it} = \beta_0 + \beta_1 \text{Shari'ah compliant dummy}_i + \sum_t^i \text{Controls} + \varepsilon_{it} \quad (1)$$

Here, environmental performance is the dependent variable. The current study uses four different proxies to measure environmental performance. Our baseline proxies for environmental performance are (1) environmental performance (Orazalin & Mahmood, 2021) and (2) environmental innovation score (Wedari, 2022). Also, this study uses two robust proxies for environmental performance: (1) emission score (Khaled, et al., 2021) and (2) CO<sub>2</sub> emission (Vieira, et al., 2022). Shari'ah compliance is the explanatory variable in this study. Shari'ah compliance is a dummy variable and takes the value of 1 if firms are classified as Shari'ah compliant under Islamic law, and 0 otherwise (Al Ansari & Alanzarouti, 2020). Following (Hayat & Hassan, 2017), the current study introduces a diverse range of firm-level control. Variables that control for firm characteristics include firm size, firm age, and debt-to-equity ratio. This study also controls for governance styles by including board size, independent directors, and CEO duality. This study also controls for state-owned ownership (Zhou, et al., 2022) and intangibles (Kiernan, 2007). Detailed definitions of variables are available in Appendix A.

This study utilises the REFINITIV database to collect environmental, Shari'ah compliance and firm-specific control variable data. REFINITIV database has been widely used in past studies (Khaled, et al., 2021; Zhou, et al., 2022) to examine environmental performance. The focus of this study is the environmental performance of Shari'ah compliant non-financial firms listed in the United States stock market. The rationale for selecting the US-listed Shari'ah-compliant firms for the current study has been discussed in the introduction section. We identify 3215 firms available in the REFINITIV database. However, most of the firms do not provide necessary firm-level or Shari'ah compliance information. After the preliminary elimination of the firms due to missing values, only 919 firms are left for the study. However,

438 firms do not provide relevant environmental performance data. Therefore, the final sample of the firm is 481 non-financial firms listed on the United State stock exchange. This study covers five years, 2017 – 2021. The rationale for selecting this timeframe is interlinked with the Paris Agreement. The Paris Agreement is a legally binding treaty on climate change which enter into force on 4 November 2016 (United Nations, 2021). Therefore, this study only explores environmental performance after 2017 to explore the potential impact of the Paris Agreement on the environmental performance of Shari’ah-compliant non-financial firms listed in the United States. The sample selection process is available in Table 1.

**[Please insert Table 1 here]**

#### **4. Results and discussion**

Table 2 provides the descriptive statistics of the study. Environmental performance has a mean score of 50.936 per cent with a minimum and maximum score of 6.262 per cent and 93.965 per cent, respectively. Such a score along with a standard deviation score of 23.900 indicate a diverse range of firms in terms of their environmental performance. Other environmental proxies also show similar patterns. Environmental innovation has a mean score of 49.895 per cent with a minimum and maximum score of 4.286 and 95.909 per cent, respectively. The emission has a mean score of 52.927 per cent with a minimum and maximum score of 2.484 and 99.227 per cent, respectively. Finally, CO<sub>2</sub> emission has a mean score of 2.077 with a minimum and maximum score of 0.057 to 18.635. 42 per cent of the sample includes Shari'ah-compliant firms with a standard deviation of 0.494. As such, this study expects to provide robust findings that cover a balance of both Shari’ah-compliant and non-compliant firms. Firms also vary according to size, age, governance style and ownership.

**[Please insert Table 2 here]**

Table 3 provides a correlation analysis of dependent, independent and control variables. The Pearson correlation scores in Table 3 indicate that none of the independent and control variables has a strong correlation with each other but has some degree of correlation with the dependent variable. As such, the current study is not affected by the multicollinearity problem.

**[Please insert Table 3 here]**

Table 4 shows the least square dummy variable (LSDV) regression results for equation 1. Past studies have also utilised an LSDV model to explore environmental performance (Zhao, et al., 2018) due to several advantages of LSDV over OLS-based estimation techniques (Hailu, 2010). Unlike OLS (Ordinary Least Square) estimation, the LSDV model allows fixed effects by introducing year and industry dummies in the econometric model (Halder & Malikov, 2020). Table 4 results indicate that Shari'ah complaint firms have better environmental performance ( $\beta = 3.513$ ,  $p < 0.05$ ) and environmental innovation ( $\beta = 5.541$ ,  $p < 0.01$ ). Such results establish a positive association between Shari'ah compliance and environmental performance for US firms.

**[Please insert Table 4 here]**

Table 5 presents robust regression results by replacing the environmental performance proxies with emission score and CO<sub>2</sub> emission to ensure the robustness of the results presented in Table 4. The emission score represents a firm's effort to reduce emissions and a high score indicates a firm's ability and initiatives to reduce emissions. Therefore, a positive coefficient ( $\beta = 5.547$ ,  $p < 0.01$ ) indicates that Shari'ah-compliant firms take greater initiative to reduce emissions as compared to non-Shari'ah-compliant firms. The negative association between Shari'ah-compliant firms and CO<sub>2</sub> emission ( $\beta = -0.271$ ,  $p < 0.10$ ) further confirms that Shari'ah-compliant firms are environmentally friendly and emit less carbon into the atmosphere through their operations.

**[Please insert Table 5 here]**

Endogeneity remains one of the critical problems that affect empirical models. There are three sources of endogeneity: (1) omitted variable bias, (2) misspecification and (3) measurement error. Unlike past studies (Azmi, et al., 2021), this study does not simply assume that the empirical model suffers from an endogeneity problem. This study performs individual checks to confirm endogeneity problems. Following Baum, et al. (2007), this study performs the Ramsey RESET test to detect omitted variable bias. Table 6 provides the Ramsey RESET test results and confirms that each version of the regression results suffers from omitted variable bias. Second, this study conducts Durbin–Wu–Hausman Specification Tests to detect misspecification bias in the empirical models following Patrick (2021). Table 6 results indicate the empirical models suffer from misspecification and confirm that OLS results are not consistent. The final test includes the Cramer-von Mises test for measurement errors following the suggestions of (Escribano, et al., 2018) and the results (Table 6) indicate empirical models

suffer from measurement errors. Table 6 results confirm that the empirical model suffers from all three sources of endogeneity problems.

**[Please insert Table 6 here]**

The next stage is to proceed with the endogeneity-correction process. The dummy nature of the independent variable restricts the possibility of performing fixed effect and system Generalised Methods of Moments (GMM) regression. In the case of both fixed effect and GMM regression, the dummy independent variable gets dropped and provides inconclusive results. Therefore, this study proceeds with propensity score-matched regression following Nazarova (2022). This study attempt to identify the treatment of environmental performance in the empirical model. Following Shipman, et al. (2017), this study assigns environmental performance to the control group using the median score and firms with higher than median environmental performance are assigned as the treatment group. Table 7 provides propensity score-matched regression results and confirms the consistency of the previous regression results after controlling for endogeneity issues.

**[Please insert Table 7 here]**

Finally, this study performs a sub-sample analysis by dividing the full sample based on: (1) research intensity, (2) Diversity, (3) board experience and (4) profitability. Ge, et al. (2022) identify a mediating influence of innovative inputs on environmental, social and governance performance. The sub-sample results in Table 8 confirm the findings of Ge, et al. (2022) and conclude that Shari'ah-compliant research-intensive firms have better environmental performance. Like Manita, et al. (2018), this study confirms that diversity does not have any significant impact on the environmental performance of Shari'ah-compliant firms. While Halid, et al. (2022) do not find a significant relationship between board tenure and environmental performance, the current study confirms that Shari'ah-compliant firms with experienced boards have better environmental performance. The final sub-sample analysis supports the findings of Saygili, et al. (2022) and confirms that low-profit Shari'ah-compliant firms have better environmental performance.

The findings presented in the current study advance the findings of Qoyum, et al. (2022) that Shari'ah compliance has a positive impact on environmental performance. While Qoyum, et al. (2022) present their findings for Indonesian and Malaysian firms, this study advances the generalizability of the findings by advancing the study findings from the context of Shari'ah-compliant firms in the United States. The study findings are also in line with the theoretical framework of Maqasid Shari'ah (Oladapo & Rahman, 2016). Therefore, H<sub>1</sub> is accepted.

## 5. Conclusion

This study explores the research question: *Do Shari'ah-compliant firms have better environmental performance?* This research question has been explored for non-financial firms listed in the United States based on data collected from the REFINITIV database. The primary rationale for selecting the United States as a case study is due to its dominance in an era led by the industry 4.0 revolution. Results based on various empirical methods confirm that US Shari'ah-compliant firms have better environmental performance. Such results have several contributions to the literature. First, limited evidence that exists on Shari'ah compliance and environmental performance is mostly in the context of emerging markets. As such, this study's findings reduce the gap by presenting the findings from a developed country perspective. Second, most of the past studies provide evidence of the environmental or CSR performance of Islamic banks. While such evidence has its unique contribution, the current study findings advance the discussion on Shari'ah compliance and environmental performance for non-financial firms operating in a diverse range of industries.

The study findings have several policy implications for regulators. Past literature promotes the importance of Islamic finance for a greener economy. The current study is unique as it promotes a greater Islamic worldview and advocates the propositions of Maqasid Shariah for a greener economic transformation. The study findings indicate that companies following ethical principles, irrespective of the label of Islamic institutions, have the potential to enhance their environmental performance. While regulators in the United States try to adopt a suitable solution to mitigate carbon emissions, the current study findings recommend the need for an economy-wide approach where firms engaging in non-Shari'ah-compliant sectors such as Alcohol, Tobacco, Pork Products and Weapon Manufacturing should be under scrutiny for the extent of carbon emission. The current study findings have wider implications for ethical investors focusing on identifying the most suitable investment that promotes the actions of environmentally friendly companies.

## References

- Al Ansari, R. & Alanzarouti, F., 2020. ESG and Islamic Finance: An Ethical Bridge Built on Shared Values. *Journal of Islamic Financial Studies*, 6(1), pp. 5-11.
- Al Haq, M. A. & Abd Wahab, N., 2019. The Maqasid Al Shariah and the sustainability paradigm: Literature review and proposed mutual framework for asnaf development. *Journal of Accounting and Finance in Emerging Economies*, 5(2), pp. 179-196.
- Ameraldo, F. & Ghazali, N. A. M., 2021. Factors Influencing the Extent and Quality of Corporate Social Responsibility Disclosure in Indonesian Shari'ah Compliant Companies. *International Journal of Business and Society*, 22(2), pp. 960-984.
- Antonakakis, N., Chatziantoniou, I. & Filis, G., 2017. Energy consumption, CO2 emissions, and economic growth: An ethical dilemma. *Renewable and Sustainable Energy Reviews*, Volume 68, pp. 808-824.
- Arsad, S. et al., 2015. Maqasid Shariah in corporate social responsibility of Shari'ah compliant companies. *Research Journal of Finance and Accounting*, 6(6), pp. 239-247.
- Ashraf, D., Rizwan, M. S. & Azmat, S., 2021. Not one but three decisions in sukuk issuance: Understanding the role of ownership and governance. *Pacific-Basin Finance Journal*, Volume 69, p. 101423.
- Ashraf, D., Rizwan, M. S. & L'Huillier, B., 2022. Environmental, social, and governance integration: The case of microfinance institutions. *Accounting & Finance*, 62(1), pp. 837-891.
- Azmi, W., Hassan, M. K., Houston, R. & Karim, M. S., 2021. ESG activities and banking performance: International evidence from emerging economies. *Journal of International Financial Markets, Institutions and Money*, Volume 70, p. 101277.
- Baum, C. F., Schaffer, M. E. & Stillman, S., 2007. Enhanced routines for instrumental variables/generalized method of moments estimation and testing. *The Stata Journal*, 7(4), pp. 465-506.
- Campisi, D., Gitto, S. & Morea, D., 2018. Shari'ah-compliant finance: A possible novel paradigm for green economy investments in Italy. *Sustainability*, 10(11), p. 3915.
- Cong, Y. & Freedman, M., 2011. Corporate governance and environmental performance and disclosures. *Advances in Accounting*, 27(2), pp. 223-232.
- Cui, J., Lapan, H. & Moschini, G., 2016. Productivity, export, and environmental performance: air pollutants in the United States. *American Journal of Agricultural Economics*, 98(2), pp. 447-467.
- Du, K., Xie, C. & Ouyang, X., 2017. A comparison of carbon dioxide (CO2) emission trends among provinces in China. *Renewable and Sustainable Energy Reviews*, Volume 73, pp. 19-25.
- Erragragui, E. & Revelli, C., 2016. Is it costly to be both shariah compliant and socially responsible?. *Review of Financial Economics*, Volume 31, pp. 64-74.
- Escribano, Á., Santos-Martín, M. T. & Sipols, A. E., 2018. A new Cramer-Von Misses cointegration test with application to environmental Kuznets curve. *Applied Economics*, 50(36), pp. 3966-3978.
- Ge, G., Xiao, X., Li, Z. & Dai, Q., 2022. Does ESG Performance Promote High-Quality Development of Enterprises in China? The Mediating Role of Innovation Input.. *Sustainability*, 14(7), p. 3843.
- Hailu, Z. A., 2010. Impact of foreign direct investment on trade of African countries. *International Journal of economics and Finance*, 2(3), pp. 122-133.

- Halder, S. C. & Malikov, E., 2020. Smoothed LSDV estimation of functional-coefficient panel data models with two-way fixed effects. *Economics Letters*, Volume 192, p. 109239.
- Halid, S., Mahmud, R., Suffian, M. T. M. & Abdul, R., 2022. Does Firm's Board Affects ESG? Malaysian Evidence. *Management*, 12(1), pp. 131-143.
- Hayat, R. & Hassan, M. K., 2017. Does an Islamic label indicate good corporate governance?. *Journal of Corporate Finance*, Volume 43, pp. 159-174.
- Jan, A., Marimuthu, M., bin Mohd, M. P. & Isa, M., 2019. The nexus of sustainability practices and financial performance: From the perspective of Islamic banking. *Journal of Cleaner Production*, Volume 228, pp. 703-717.
- Khaled, R., Ali, H. & Mohamed, E. K., 2021. The Sustainable Development Goals and corporate sustainability performance: Mapping, extent, and determinants. *Journal of Cleaner Production*, Volume 311, p. 127599.
- Kiernan, M. J., 2007. Universal owners and ESG: Leaving money on the table?. *Corporate Governance: An International Review*, 15(3), pp. 478-485.
- Maali, B., Casson, P. & Napier, C., 2006. Social reporting by Islamic banks. *Abacus*, 42(2), p. 266-289.
- Mallin, C., Farag, H. & Ow-Yong, K., 2014. Corporate social responsibility and financial performance in Islamic banks. *Journal of Economic Behavior & Organization*, Volume 103, pp. 21-38.
- Manita, R., Bruna, M. G., Dang, R. & Houanti, L. H., 2018. Board gender diversity and ESG disclosure: evidence from the USA. *Journal of Applied Accounting Research*, 19(2), pp. 206-224.
- Meo, M. S. & Abd Karim, M. Z., 2022. The role of green finance in reducing CO2 emissions: An empirical analysis. *Borsa Istanbul Review*, 22(1), pp. 169-178.
- Miftahorrozi, M., Khan, S. & Bhatti, M. I., 2022. Waste Bank-Socio-Economic Empowerment Nexus in Indonesia: The Stance of Maqasid al-Shari'ah. *Journal of Risk and Financial Management*, 15(7), p. 294.
- National Climate task Force, 2022. *Take climate action in your community*. [Online] Available at: <https://www.whitehouse.gov/climate/#:~:text=Reducing%20U.S.%20greenhouse%20gas%20emissions,clean%20energy%20to%20disadvantaged%20communities> [Accessed 28 07 2022].
- Nazarova, V., 2022. Do ESG Factors Influence Investment Attractiveness of the Public Companies?. *Journal of Corporate Finance Research*, 16(1), pp. 38-64.
- Oladapo, I. A. & Rahman, A. A., 2016. Re-counting the determinant factors of human development: a review of the literature. *Humanomics*, 32(2), pp. 205-226.
- Orazalin, N. & Mahmood, M., 2021. Toward sustainable development: Board characteristics, country governance quality, and environmental performance. *Business Strategy and the Environment*, 30(8), pp. 3569-3588.
- Our World in Data, 2017. *Who emits the most Co2?*. [Online] Available at: <https://ourworldindata.org/co2-emissions>
- Patrick, R. H., 2021. Durbin–Wu–Hausman Specification Tests. In: C. F. Lee & J. C. Lee, eds. *In Handbook of Financial Econometrics, Mathematics, Statistics, and Machine Learning*. s.l.:World Scientific, pp. 1075-1108.

- Post, C., Rahman, N. & McQuillen, C., 2015. From board composition to corporate environmental performance through sustainability-themed alliances. *Journal of Business Ethics*, 130(2), pp. 423-435.
- Qoyum, A., Sakti, M. R. P., Thaker, H. M. T. & AlHashfi, R. U., 2022. Does the Islamic label indicate good environmental, social, and governance (ESG) performance? Evidence from sharia-compliant firms in Indonesia and Malaysia. *Borsa Istanbul Review*, 22(2), pp. 306-320.
- Ritchie, H. & Roser, M., 2020. *CO<sub>2</sub> and Greenhouse Gas Emissions*. [Online] Available at: <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions> [Accessed 26 7 2020].
- Saygili, E., Arslan, S. & Birkan, A. O., 2022. ESG practices and corporate financial performance: Evidence from Borsa Istanbul. *Borsa Istanbul Review*, 22(3), pp. 525-533.
- Scholten, B. & Dam, L., 2007. Banking on the equator. Are banks that adopted the equator principles different from non-adopters?. *World Development*, 35(8), pp. 1307-1328.
- Shipman, J., Swanquist, Q. & Whited, R., 2017. Propensity score matching in accounting research. *Accounting Review*, Volume 92, pp. 213-244.
- Tiwari, A. K., Nasir, M. A., Shahbaz, M. & Raheem, I. D., 2021. Convergence and club convergence of CO<sub>2</sub> emissions at state levels: A nonlinear analysis of the USA. *Journal of Cleaner Production*, Issue 125093, p. 288.
- Uluyol, B., 2021. A comprehensive empirical and theoretical literature survey of Islamic bonds (sukuk). *Journal of Sustainable Finance & Investment*, pp. 1-23.
- United Nations, 2021. *Nationally determined contributions under the Paris*, Glasgow: United Nations.
- United Nations, 2022. *Department of Economic and Social Affairs*. [Online] Available at: <https://sdgs.un.org/topics/climate-change>
- Vieira, L. C., Longo, M. & Mura, M., 2022. From carbon dependence to renewables: The European oil majors' strategies to face climate change. *Business Strategy and the Environment*, Issue Forthcoming.
- Wedari, L. K. M. A. & J. C., 2022. The moderating effect of innovation on the relationship between environmental and financial performance: Evidence from high emitters in Australia. *Business Strategy and the Environment*, Issue Forthcoming.
- Yaakub, S. & Abdullah, N. A. H. N., 2020. Towards Maqasid Shariah In Sustaining The Environment Through Impactful Strategies. *International Journal of Islamic Business*, 1(36-45), p. 5.
- Zhang, Y. J., Bian, X. J., Tan, W. & Song, J., 2017. The indirect energy consumption and CO<sub>2</sub> emission caused by household consumption in China: an analysis based on the input-output method. *Journal of cleaner production*, Volume 163, pp. 69-83.
- Zhao, C. et al., 2018. ESG and corporate financial performance: Empirical evidence from China's listed power generation companies. *Sustainability*, 10(8), p. 2607.
- Zhou, G., Liu, L. & Luo, S., 2022. Sustainable development, ESG performance and company market value: Mediating effect of financial performance. *Business Strategy and the Environment*, Issue Forthcoming .

Table 1: Sample selection

Total number of non-financial US firms available in Refinitiv	3215
(Less) Firms with missing firms level data	2296
Total number of non-financial US firms with available data	919
(Less) Number of firms with missing environmental performance data	438
Final sample firms	481

Table 2: Descriptive statistics

Variables	Obs	Mean	Std. dev.	Min	Max
<i>Panel A: Dependent variables</i>					
<u>Baseline proxy</u>					
Environmental performance	1,860	50.936	23.900	6.262	93.965
<u>Robust proxies</u>					
Environmental innovation score	1,860	49.895	23.768	4.286	95.909
Emission score	1,693	52.927	28.637	2.484	99.227
CO2 emission	1,860	12.077	2.319	0.057	18.635
<i>Panel B: Explanatory variables</i>					
Shari'ah compliant firms	1,860	0.424	0.494	0.000	1.000
<i>Panel C: Firm controls</i>					
Firm size	1,860	23.116	0.729	20.830	26.061
Firm age	1,842	38.858	30.824	2.000	130.000
Debt to equity ratio	1,860	0.603	0.177	0.164	1.071
Board size	1,860	2.272	0.217	1.609	2.708
Independent directors	1,860	4.404	0.139	3.758	4.541
CEO Duality	1,860	0.603	0.489	0.000	1.000
State ownership	1,856	50.078	0.024	50.043	50.112
Intangibles	1,579	19.458	2.138	13.691	24.072

Table 3: Correlation analysis

No	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Environmental performance	1.000												
2	Environmental innovation score	0.546*	1.000											
3	Emission score	0.850*	0.213*	1.000										
4	CO2 emission	0.179*	0.119*	0.1930*	1.000									
5	Shari'ah compliant firms	-0.079	0.042	-0.056*	-0.089*	1.000								
6	Firm size	0.022	0.006	-0.015	-0.130*	-0.077*	1.000							
7	Firm age	0.194*	0.137*	0.093*	0.100*	0.064*	-0.218*	1.000						
8	Debt to equity ratio	-0.005	-0.047*	0.098*	0.005	-0.030	0.074*	-0.125*	1.000					
9	Board size	0.450*	0.202*	0.369*	0.244*	-0.168*	-0.071*	0.279*	-0.013	1.000				
10	Independent directors	0.220*	0.126*	0.169*	0.122*	0.007	-0.115*	0.214*	-0.016	0.252*	1.000			
11	CEO duality	0.135*	0.045	0.145*	0.029	-0.015	-0.080*	0.115*	-0.030	0.133*	-0.048*	1.000		
12	State ownership	0.052*	0.023	-0.006	-0.063*	0.013	0.166*	-0.023	0.092*	-0.044	0.038	-0.063*	1.000	
13	Intangibles	0.490*	0.239*	0.368*	0.145*	-0.165*	-0.017	0.298*	0.005	0.5262*	0.240*	0.119*	-0.060*	1.000

Table 4: Do Shari'ah compliant firms have better environmental performance?

	Environmental performance	Environmental innovation score
Shari'ah compliant firms	3.513** (1.100)	5.541*** (1.369)
Firm size	0.989 (0.786)	0.124 (0.867)
Firm age	0.027 (0.017)	0.015 (0.025)
Debt to equity ratio	-7.303** (2.756)	-9.131** (3.519)
Board size	28.955*** (2.809)	10.946*** (3.278)
Independent director	4.045 (4.071)	6.808 (4.076)
CEO Duality	2.582* (1.015)	0.326 (1.255)
State ownership	-19.070 (37.282)	7.416 (44.029)
Intangibles	3.915*** (0.303)	2.484*** (0.355)
Intercept	816.757 (1864.186)	-428.839 (2201.951)
<i>Year fixed effect</i>	Yes	Yes
<i>Industry fixed effect</i>	Yes	Yes
Observation	1559	1559
R <sup>2</sup>	0.469	0.189
F-statistic	75.53***	28.05***

Note: We perform least square dummy variable regression (LSDV) by including both year and industry fixed effects in our regression equation:

$$Environmental\ performance_{it} = \beta_0 + \beta_1 Shari'ah\ compliant\ dummy_i + \sum_i^i Controls + \varepsilon_{it}$$

Environmental performance is the dependent variable and is measured using two proxies: the environmental pillar score and the environmental innovation score. Shari'ah-compliant firms are the independent variable, which is a dummy variable, and takes a value of 1 if the firm is categorized as a Shari'ah-compliant firm in Refinitiv, 0 otherwise. We include a wide variety of controls to capture firm characteristics in our empirical model. Scores in the parentheses are standard errors. \*, \*\*, \*\*\* represent significance at 10, 5 and 1 per cent levels.

Table 5: Robustness tests

	Emission score	CO <sub>2</sub> emission
Shari'ah compliance dummy	5.547*** (1.486)	-0.271* (0.09)
Firm size	0.424 (1.025)	-0.025 (0.06)
Firm age	-0.018 (0.025)	-0.002 (0.001)
Debt to equity ratio	4.354 (3.846)	-0.137 (0.249)
Board size	33.719*** (3.830)	3.008*** (0.250)
Independent director	6.748 (5.538)	0.549 (0.343)
CEO Duality	4.181** (1.373)	0.320* (0.092)
State ownership	-26.178 (51.546)	-1.6407 (1.885)
Intangibles	3.360*** (0.416)	0.340*** (0.025)
Intercept	1172.122 (2578.12)	67.233 (93.550)
<i>Year fixed effect</i>	Yes	Yes
<i>Industry fixed effect</i>	Yes	Yes
Observation	1409	1559
R <sup>2</sup>	0.389	0.342
F-statistic	56.95***	91.12***

Note: We perform least square dummy variable regression (LSDV) by including both year and industry fixed effects in our regression equation:

$$Environmental\ perform_{it} = \beta_0 + \beta_1 Shari'ah\ compliant\ dummy_i + \sum_t^i Controls + \varepsilon_{it}$$

Environmental performance is the dependent variable and is measured using two proxies: emission score and CO<sub>2</sub> emission. Shari'ah-compliant firms are the independent variable, which is a dummy variable, and takes a value of 1 if the firm is categorized as a Shari'ah-compliant firm in Refinitiv, 0 otherwise. We include a wide variety of controls to capture firm characteristics in our empirical model. Scores in the parentheses are standard errors. \*, \*\*, \*\*\* represent significance at 10, 5 and 1 per cent levels.

Table 6: Endogeneity Checks

	Environmental pillar score	Environmental innovation score	Emission score	CO2 emission
Ramsey RESET test for omitted variable				
H <sub>0</sub> : Model has no omitted variables				
F-statistic	7.640	5.680	2.130	2.670
P-value	0.000	0.001	0.094	0.046
<i>Decision: Null rejected; the empirical model suffers from omitted variable bias.</i>				
Durbin-Wu-Hausman test for misspecification				
H <sub>0</sub> : OLS is not consistent.				
F-statistic	97.80	13.70	109.12	84.46
P-value	0.000	0.000	0.000	0.000
<i>Decision: Null rejected; therefore, the OLS results are not reliable.</i>				
Cramer-von Mises test for measurement errors				
H <sub>0</sub> : No measurement error				
Number of observations	1860	1860	1860	1860
Number of bootstrap samples	500	500	500	500
CvM	0.001	7.581	10.535	0.122
P value	0.954	0.326	0.230	0.070
Bootstrap critical value 5%	0.009	17.17	19.69	0.134
<i>Decision: Null cannot be rejected, the empirical model suffers from measurement errors</i>				
<i>Overall decision on endogeneity: The empirical model suffers from an endogeneity problem.</i>				

Note: Past literature identified three common sources of endogeneity problems in regression models, which include omitted variable bias, misspecification, and measurement error. Instead of assuming that our regression model suffers from the endogeneity problem, we perform three distinct tests to confirm each source of the endogeneity problem that could affect our model. Based on the results, we reach the following conclusion: our empirical model is

1. affected by omitted variable bias.
2. does not provide consistent findings under OLS estimation.
3. Has measurement error.

\*, \*\*, \*\*\* represent significance at 10, 5 and 1 per cent levels.

Table 7: Propensity score matched regression (Endogeneity correction)

	Environmental performance	Environmental innovation score	Emission score	CO2 emission
Shari'ah compliance dummy	3.498** (1.101)	5.511*** (1.370)	5.564*** (1.486)	-0.270* (0.092)
Firm size	0.929 (0.793)	0.065 (0.877)	0.385 (1.037)	-0.039* (0.065)
Firm age	0.027 (0.018)	0.017 (0.026)	-0.019 (0.025)	-0.002 (0.001)
Debt to equity ratio	-7.058* (2.765)	-8.660* (3.531)	4.577 (3.863)	-0.177 (0.250)
Board size	28.879*** (2.820)	10.922*** (3.284)	33.697*** (3.844)	3.009*** (0.252)
Independent director	3.412 (4.145)	6.988 (4.101)	4.912 (5.725)	0.650 (0.353)
CEO Duality	2.564* (1.027)	0.416 (1.268)	4.064** (1.390)	0.315* (0.093)
State ownership	-18.539 (37.355)	10.058 (44.147)	-26.867 (51.593)	-1.331 (1.885)
Intangibles	3.930*** (0.304)	2.461*** (0.356)	3.414*** (0.418)	0.338*** (0.025)
Intercept	793.250 (1867.891)	-560.428 (2207.832)	1213.412 (2580.466)	63.371 (94.059)
<i>Year fixed effect</i>	Yes	Yes	Yes	Yes
<i>Industry fixed effect</i>	Yes	Yes	Yes	Yes
Observations	1548	1548	1398	1548
R <sup>2</sup>	0.468	0.189	0.388	0.304

Note: This table provides regression results on propensity score matched sample. We use Shari'ah-compliant firms as a treatment group to control for endogeneity problems that might exist in the full sample.

We perform least square dummy variable regression (LSDV) by including both year and industry fixed effects in our regression equation:

$$Environmental\ performance_{it} = \beta_0 + \beta_1 Shari'ah\ compliant\ dummy_i + \sum_t^i Controls + \varepsilon_{it}$$

Environmentally friendly is the dependent variable and is measured using two proxies: emission score and CO<sub>2</sub> emission. Shari'ah-compliant firms are the independent variable, which is a dummy variable, and takes a value of 1 if the firm is categorized as a Shari'ah-compliant firm in Refinitiv, 0 otherwise. We include a wide variety of controls to capture firm characteristics in our empirical model. Scores in the parentheses are standard errors. \*, \*\*, \*\*\* represent significance at 10, 5 and 1 per cent levels.

Table 8: Sub-sample tests

	Research Intensity		Diversity		Board experience		Profitability	
	High	Low	High	Low	High	Low	High	Low
Shari'ah compliance dummy	5.852*	-2.982	1.258	2.188	3.871*	-1.356	-1.466	3.654*
	(2.363)	(1.692)	(1.982)	(1.935)	(2.034)	(2.009)	(2.083)	(1.933)
Firm size	2.226	-1.242	2.412	-0.993	-3.054	0.559	-1.536	1.545
	(1.807)	(1.159)	(1.667)	(1.204)	(2.401)	(1.117)	(1.487)	(1.391)
Firm age	-0.118**	-0.034	-0.035	-0.122***	-0.073	-0.077*	-0.045	-0.103**
	(0.043)	(0.030)	(0.034)	(0.035)	(0.038)	(0.033)	(0.037)	(0.034)
Debt to equity ratio	5.621	10.192*	5.006	6.979	4.782	12.292*	7.709	9.425
	(6.409)	(4.585)	(5.833)	(5.022)	(5.586)	(5.381)	(5.971)	(5.422)
Board size	24.843***	38.069***	39.799***	26.027***	29.899***	43.614***	34.729***	36.437***
	(7.144)	(4.516)	(5.616)	(5.297)	(5.551)	(5.618)	(6.097)	(5.161)
Independent director	26.541*	7.331	10.647	-0.639	6.475	13.714*	20.241*	6.945
	(12.622)	(5.952)	(10.336)	(6.435)	(9.747)	(6.596)	(9.212)	(6.923)
CEO Duality	-3.655	8.700***	6.645**	2.701	6.507**	3.893*	1.563	8.018***
	(2.501)	(1.646)	(2.054)	(1.917)	(2.168)	(1.948)	(2.140)	(1.929)
State ownership	56.746	9.940	25.328	-48.527	11.017	28.482	49.654	-3.469
	(48.211)	(34.419)	(43.606)	(38.473)	(42.514)	(40.457)	(44.882)	(38.976)
Intangibles	3.473***	1.891***	1.537**	4.575***	2.987***	3.355***	2.975***	3.448***
	(0.739)	(0.464)	(0.545)	(0.525)	(0.549)	(0.551)	(0.578)	(0.531)
Intercept	-3072.837	-585.309	-1440.565	2351.844	-591.012	-1618.211	-2628.895	1.039
	(2405.572)	(1716.908)	(2173.869)	(1922.285)	(2117.151)	(2019.363)	(2239.986)	(1944.312)
Observations	383	1026	699	710	686	723	630	779
R <sup>2</sup>	0.179	0.191	0.169	0.203	0.170	0.243	0.207	0.209

Note: This table provides sub-sample analysis by dividing the sample into four categories: (1) research-intensive, (2) diverse, (3) experience board and profitable firms. Scores in the parentheses are standard errors. \*, \*\*, \*\*\* represent significance at 10, 5 and 1 per cent levels.

## Appendix

### Appendix A: Variable definition

Variables	Definition	Source
<i>Panel A: Dependent variables</i>		
<u>Baseline proxy</u>		
Environmental performance	The environmental pillar measures a company's impact on living and non-living natural systems	Refinitiv
<u>Robust proxies</u>		
Environmental innovation score	Environmental innovation category score reflects a company's capacity to reduce the environmental costs and burdens for its customers	Refinitiv
Emission score	Percentage of target annual reduction in emissions as reported by the company.	Refinitiv
CO2 emission	Natural logarithm of total annual CO <sub>2</sub> emission.	Refinitiv
<i>Panel B: Independent variable</i>		
Shari'ah compliant firms	Dummy variable. 1 for stocks that are considered compliant with Shari'ah or Islamic law, 0 otherwise. Refinitiv classified non-firms as Shari'ah compliant if they do not invest in non-Shari'ah compliant sectors (as per Islamic Law) such as Alcohol, Tobacco, Pork products, Pornography, Gambling, and Military Weapons.	Refinitiv
<i>Panel C: Firm controls</i>		
Firm size	Natural logarithm of total asset.	Author calculation
Firm age	Number of years the firm is in operation since incorporation	Author calculation
Debt to equity ratio	Ratio of total long-term liabilities to total equity	Author calculation
Board size	Total number of directors on the board.	Refinitiv
Independent directors	Total number of independent directors on the board.	Refinitiv
CEO Duality	Dummy variable, 1 if CEO also has the role of Chairman, 0 otherwise.	Refinitiv
State ownership	Percentage of the firm owned by state.	Refinitiv
Intangibles	Represents intangibles reduced by accumulated intangibles amortised.	Refinitiv

## Appendix B: Industry-specific distribution of environmental performance

Industry	Environmental performance	
	Shari'ah non-compliant	Shari'ah non-compliant
Auto Components	38.263	38.152
Automobiles	40.388	47.564
Building Products	40.918	45.192
Chemicals	44.668	42.065
Commercial Services & Supplies	43.093	54.644
Communications Equipment	41.194	65.088
Construction & Engineering	30.443	27.150
Containers & Packaging	47.767	57.231
Diversified Telecommunication Services	63.562	20.180
Electric Utilities	70.025	43.865
Electrical Equipment	38.335	32.992
Electronic Equipment, Instruments & Components	51.150	54.288
Energy Equipment & Services	64.357	17.148
Equity Real Estate Investment Trusts (REITs)	51.560	55.267
Food Products	65.662	60.664
Health Care Equipment & Supplies	36.344	49.169
Hotels, Restaurants & Leisure	83.571	19.856
Household Durables	38.560	36.664
Household Products	55.449	65.307
Internet & Direct Marketing Retail	67.781	43.393
IT Services	73.038	67.442
Leisure Products	54.057	53.134
Life Sciences Tools & Services	60.022	70.225
Machinery	45.893	47.433
Metals & Mining	43.258	47.077
Multi-Utilities	55.814	73.589
Oil, Gas & Consumable Fuels	35.832	66.959
Paper & Forest Products	46.517	20.937
Pharmaceuticals	80.941	76.605
Professional Services	50.148	65.586
Semiconductors & Semiconductor Equipment	52.952	52.453
Software	59.126	61.222
Speciality Retail	45.306	59.069
Technology Hardware, Storage & Peripherals	25.916	51.119
Textiles, Apparel & Luxury Goods	57.384	43.606
Trading Companies & Distributors	43.625	39.340