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Article

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The Impact of Islamic Financial Development, GDP, and Population on Environmental Quality in Indonesia

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ABSTRACT

Environmental problems are becoming an issue along with the issue of global warming whose impacts are increasingly being felt. Cases of environmental destruction in Indonesia are increasing, so several directions of government policies have started toward sustainable development goals (SDGs). The situation has challenged Islamic finance, an alternative financial system that is said to be the answer to the current toxic financial system, to prove itself to support the environment quality. This research aims to determine the impact of Islamic financial development, Gross Domestic Product (GDP), and population on the environmental quality in Indonesia using data spanning from 2016 to 2020. The results show that GDP significantly impacts the environmental quality of almost all major islands in Indonesia. Overall, in the territory of Indonesia Islamic financial development had a significantly negative effect at a significant level of 10% on environmental quality.

Keywords: Islamic Financial Development, Gross Domestic Product, Population, Environmental Quality
JEL Classifications: O44, Q43, Q56

1. INTRODUCTION

Currently, the environmental quality index is calculated based on two parameters, namely nitrogen dioxide (NO_2) and sulfur dioxide (SO_2), which previously included other parameters, namely oxidant/ozone on the surface, particulate matter, and carbon monoxide (CO). The NO_2 parameter represents emissions from gasoline-fueled motor vehicles, and SO_2 represents emissions from industrial and diesel-fueled vehicles and other sulfur-containing fuels. The environmental quality index value is influenced by various factors such as related sector policies to support air pollution control, support from other parties such as local governments, relevant agencies, communities, and business actors, and the availability of funding from both the government and business actors' side, as well as natural factors (KLHK, 2016).

The performance of Islamic finance in Indonesia during the pandemic continues to experience strong growth to maintain economic stability during the revival of the national economy. The Indonesian Sharia Financial Services Sector consists of 3 subsectors, namely, Sharia Banking, Sharia Non-Bank Financial Industry (Insurance, Financing Companies, Other Sharia Non-Bank Institutions), and Sharia Capital Market (State Sukuk, Corporate Sukuk, and Sharia Mutual Funds). The development of Islamic financial assets in Indonesia 2014-2021 is available in Table 1. In addition, a graph of asset development from that year is available in Figure 1 (OJK, 2021).

Environmental quality is not only affected by the economic activities only but also from the growing size of demography. An analysis of the impact of population growth on CO_2 emissions from 1990 to 2018 in Indonesia has been carried out by Dong et al. (2018), Mendonça et al. (2020) and Zulaicha et al. (2020). Those study showed that population growth has a positive and significant effect on CO_2 emissions. In addition, several studies examine population and CO_2 emissions, including Bai et al.

Table 1: Islamic financial assets in Indonesia (in trillion rupiah)

Year	Sharia banking	Sharia non-bank financial industry	Sharia capital market	Total
2014	278.90	58.39	224.50	561.79
2015	304.00	64.89	318.50	687.39
2016	365.70	88.69	439.40	893.77
2017	435.02	99.13	595.61	1129.77
2018	489.69	97.12	700.84	1287.65
2019	538.32	105.56	824.19	1468.07
2020	608.90	116.28	1076.22	1801.40
2021	693.80	120.81	1235.83	2050.44

Figure 1: Average of the value of the observed variables on 2016-2020

(2019). The research explained that China's increasing urban population significantly affects residential CO_2 emissions. The research was supported by Lin and Raza (2019) who explained that population variables are important factors responsible for the increase in CO_2 emissions. Balezentis (2020) also has the same findings with the addition of the population's lifestyle as a factor affecting CO_2 emission.

Despite its importance, research related to the influence of Islamic financial development, GDP, and population on environmental quality in Indonesia is still scarce. Therefore, this study aims to examine the relationship between Islamic financial development, GDP, and population on the environmental quality level in Indonesia. The statistical analysis model used in this study is panel data because there are demographic/regional elements. The data is segregated based on the five largest islands in Indonesia including Sumatra, Jawa, Kalimantan, Sulawesi, and Papua. Smaller islands, such as Bali, Nusa Tenggara, etc., have been included in the nearest largest island. For example, in this case, Bali has been included in the island of Jawa.

2. LITERATURE REVIEW

Several Studies on the influence of GDP and population on environmental quality are done by many researchers in many countries. For instance, Islami et al. (2022) investigated the impact of population, GDP, consumption of non-renewable energy and consumption of renewable energy on CO_2 emissions (COEs) in the G-20 member countries from 2010 to 2019. The findings show that the population and consumption of non-renewable energy had a positive and significant effect on COEs in the G-20 Member Countries. Although GDP had shown a positive direction, its impact was statistically insignificant on COEs. Lastly, as expected, the consumption of renewable energy has shown a negative and significant impact on COEs in the G-20 Member States. A similar study by Perwithosuci et al. (2020) took place in Malaysia, Indonesia, Thailand, the Philippines, and Vietnam from 1985 to 2017. Using fixed-effect panel data estimation, the findings showed that the population, GDP, and oil consumption significantly positively affect CO_2 emissions. The results of study obtained by Le (2022) show that the total electricity generation from different energy sources is found to be the most important variable interacting positively with both energy consumption and CO_2 emissions.

Abduh et al. (2022) confirmed that another exciting variable that could influence the volatility of the environmental quality level is financial development. There are many works in this area that have been published and among them are Cetin and Bakirtas (2019) and Raghutla and Chittedi (2021). Interestingly, despite the anonymous conclusion of the significant impact of financial development on environmental quality, the direction of the relationship is still ambiguous. For instance, Cetin and Bakirtas (2019) evidenced that financial development increases environmental degradation while Raghutla and Chittedi (2021) confirmed that financial development reduces CO_2 emission.

The relationship between GDP and CO_2 emissions has been studied by Sikder et al. (2022). The study used the Panel Autoregressive Distributed Lag (ARDL) model to analyze the combined effects of energy use, industrialization, gross domestic product (GDP) growth, and urbanization on CO_2 emissions. These results confirmed that CO_2 emissions are affected by GDP growth, energy use, industrialization, and urbanization. In addition, the study has identified a reciprocal causal correlation between urbanization, GDP growth, industrialization, energy, and CO_2 emissions. However, the impact of this pollution growth will not be comparable to the abatement effect of high-income countries, given that they make the most significant overall contribution to global emissions (Llanos et al., 2022). Zubair et al. (2020) confirmed based on the cointegration test, a long-term relationship between carbon emissions (CO_2) and income. Also based on Granger causality results show one-way causality occurs from modal to CO_2 emissions. Mohsin et al. (2022) explained a significant negative relationship in the long term and a positive relationship in the short term between CO_2 emissions and GDP. In China, GDP per capita worsens CO_2 emissions in the long run. The impulse analysis of variance decomposition highlights the time lag of CO_2 emissions and GDP per capita, which are significant predictors of China's CO_2 emissions, respectively (Aslam et al., 2021).

Li et al. (2015) investigated the relationship between financial development, environmental quality, and economic growth in 102 countries from 1980-2010 using the generalized method of moment (GMM) estimation. The finding showed that there was a significant "inverted U-shaped" relationship between economic growth and carbon emissions, which showed that there was a "tipping point"

where the achievement of economic development must sacrifice environmental quality. After passing the critical point, the decline in ecological quality would cause a significant slowdown in economic growth. Thus, there was a mutually encouraging and strengthening relationship between financial development and environmental quality. Ivantri (2019) studied the relationship between financial access and the dimensions of sustainable development in OIC countries and concluded that financial access does not significantly affect economic growth and environmental quality but has a positive effect on human development.

In the Islamic finance framework, published works on this topic are very limited. Among them are Iskandar et al. (2020) who studied the dynamic relationship between CO_2 emissions, Islamic financial development, and economic growth in Indonesia using the Environmental Kuznets Curve (EKC) approach. The findings showed no significant short-term dynamic relationships between growth, development of Islamic finance, and CO_2 emissions. However, the long-run findings suggested that CO_2 emissions from transport; other sectors, excluding residential buildings and commercial and public services; and the residential buildings and commercial and public services sectors were significantly associated with Islamic financial development in Indonesia, thus forcing the country to adjust CO_2 emissions level by promoting environmentally friendly activities, cost efficiency and the development of Islamic finance.

Another recent study by Abduh et al. (2022) could help to understand this issue from the Islamic financial framework. The study explored the impact of Islamic financial development on energy consumption and environmental quality. Total financing and financial access were the two variables representing Islamic financial advancement while millions of tons of oil equivalent and CO_2 emission as the proxy for energy consumption and environmental quality respectively. Focusing on six world top Islamic finance countries from 2013 to 2018, the findings show that Islamic financial development contributes significantly to the increase in energy consumption and the degradation of environmental quality.

3. DATA AND METHODS

This research uses a descriptive study with a quantitative approach upon three independent variables and one dependent variable. Environmental quality is a dependent variable measured from the air quality index; the independent variables are Islamic financing based on Sharia financing (in billion rupiah), Gross Domestic Product - GDP (in billion rupiah), and Population (in thousand people). This study uses secondary data which were obtained from The Ministry of Environment and Forestry (environmental quality data), BPS - Statistics Indonesia (GDP data), and The Financial Services Authority - OJK (Sharia financing data). Annual time series data starting from 2016 to 2020 are presented based on five big islands in Indonesia, namely Sumatera (covered ten provinces in Sumatera), Jawa (covered nine provinces in Jawa, Bali, and Nusa Tenggara), Kalimantan (covered five provinces in Kalimantan), Sulawesi (covered six provinces in Sulawesi), and Papua (covered four provinces in Maluku and Papua). The total sample size that is clear for the analysis is 170.

This study utilizes panel data regression analysis which has three models that can be used to estimate the panel data regression (eq. 1), namely the Common Effect Model (eq. 2), Fixed Data Model (eq. 3), and Random Data Model (eq. 4). To determine the best estimation model, previously, the model suitability test was carried out with the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test. Then, the significance test was carried out by conducting a statistical test consisting of an F-test, t-test, and Adjusted-R2 test.

$$Z_{it} = Y_i' \alpha + X_{it}' \beta + \varepsilon_{it} \tag{1}$$

$$Z_{it} = \alpha + X_{it}' \beta + \varepsilon_{it} \tag{2}$$

$$Z_{it} = \alpha_i + X_{it}' \beta + \varepsilon_{it} \tag{3}$$

$$Z_{it} = \alpha + X_{it}' \beta + u_i + \varepsilon_{it} \tag{4}$$

where $i = 1,\ldots, N$, $t = 1,\ldots, T$, i denotes the unit cross-section, t denotes the amount of time, then there is P independent variable in X_{it} which does not include constant, $Y_i' \alpha$ show individual specific effects, β shows the slop matrix of size $Px1$, ε_{it} is error, u_t is a specific random effect for the i-th observation. In eq. 3, α_i is $Y_i' \alpha_i$ indicating the observed effect and specifying the conditional mean that can be estimated. Then α_i is treated as an unknown fixed parameter and will be estimated. Y_i is assumed to be unobserved and has a correlation with the independent variable. While in eq. 4, α $E[Y\alpha]$ and $u_i = \left\{ Y_i' \alpha - E[Y_i' \alpha] \right\}$. In this model u_i it is assumed to be independent with ε_{it}.

4. RESULTS

4.1. Descriptive Analysis

This study uses environmental quality as the dependent variable and Islamic financial development, GDP, and population as independent variables. In this study, data from 2016-2020 are gathered from 34 provinces which were later grouped into five, based on big islands in Indonesia, i.e. Sumatera, Jawa, Kalimantan, Sulawesi, and Papua. Based on Figure 2, the highest environmental quality was in 2017 at 89.03 with an increase of 6.59 from the previous year. Then, from 2017, environmental quality decreased to 86.53 and then increased to 88.27 in 2020. Table 2 shows that the average environmental quality in Indonesia is 86.84 with the highest average being on the island of Papua at 90.90 which includes Maluku, Maluku Utara, Papua, and Papua Barat. Then followed by the region of Sulawesi, Kalimantan, and Sumatera. Jawa has the lowest environmental quality at 80.95.

Based on Table 3, Jawa is the region with the most significant Islamic financial development, GDP, and a population that covers nine provinces in Indonesia including the provinces of Bali, Nusa Tenggara Barat, and Nusa Tenggara Timur. The Islamic financial development in Indonesia from 2016 to 2020 has decreased from 956.18 in 2016 to 366.04 in 2020. This is different from the GDPs in Indonesia which increased from 2016 to 2019 from 371230.38 to 471870.71 and then decreased by 7561.92 to 464308.79. The average population in Indonesia from 2016 to 2020 has increased and decreased every year until it reached the highest average in 2020, which is 7803.
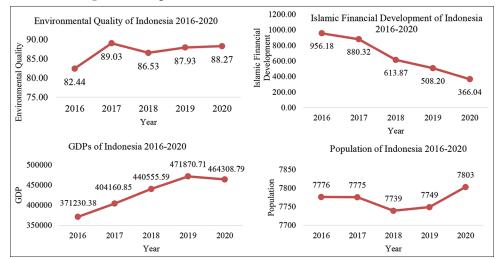
Figure 2: Average of the value of the observed variables on 2016-2020

Table 2: Five years average (2016-2020) of the value of the observed variables

Region	Environmental quality (Air quality index)	Islamic financial development (Billion rupiah)	GDP (Billion rupiah)	Population (Thousand)
Sumatera	87.60	441.90	315628.02	4328
Jawa	80.95	1540.06	1002624.76	11061
Kalimantan	88.62	315.91	235787.88	9507
Sulawesi	90.23	442.76	154659.83	8967
Papua	90.90	22.90	86914.40	5012
Indonesia	86.84	664.92	430425.26	7769

Table 3: Summary of panel data analysis for environmental quality

Island	Model	Adjusted R^2	F-stat (Prob.)		Variable	Coef.	Prob.of t-stat
Sumatera	Fixed effect (*Original data*)	21.93%	2.15	(0.04)	*Const.*	72.54	0.000
					Islamic financial development	−3.E-03	0.495
					GDP	5.E-05	0.036**
					Population	2.E-05	0.922
Jawa, Bali, Nusa Tenggara	Random effect (*Original data*)	35.36%	9.08	(0.00)	*Const.*	88.08	0.000
					Islamic financial development	−1.2E-03	0.186
					GDP	−4.7E-06	0.012**
					Population	−5.2E-05	0.516
Kalimantan	Fixed effect (*Original data*)	48.40%	4.21	(0.01)	*Const.*	74.88	0.000
					Islamic financial development	−2.E-03	0.517
					GDP	6.E-05	0.021***
					Population	6.E-05	0.356
Sulawesi	Random effect (*Logarithm data*)	27.72%	4.71	(0.01)	*Const.*	4.49	0.000
					Islamic financial development	−0.02	0.018**
					GDP	0.01	0.105
					Population	−0.01	0.047**
Maluku, Papua	Fixed effect (*Logarithm data*)	41.29%	3.23	(0.04)	*Const.*	2.88	0.007
					Islamic financial development	0.01	0.451
					GDP	0.13	0.108
					Population	0.02	0.180
Indonesia	Random effect (*Original data*)	51.13%	59.94	(0.00)	*Const.*	90.36	0.000
					Islamic financial development	−9.E-04	0.079*
					GDP	−6.E-06	0.000**
					Population	−2.E-05	0.499

*Significant at 10%; **Significant at 5%

4.2. Panel Data Analysis

The Chow test shows that the Chi-square probability value is 0.0000. So, in this case, it states that Ho is rejected, which means that the best model according to the Chow test is the Fixed Effect. However, the Hausman test result shows that the probability value is 0.2813, where Ha is rejected, which means that the best model according to the Hausman Test is Random Effect. And then, based on the LM test show the Breusch-Pagan probability value of 0.0000 (In Both columns). So, in this case, it states that Ho is rejected which means the best model according to the LM Random Effect Test.

With an alpha of 5%, the test output shows that GDP has a negative and significant impact on environmental quality in Sumatra, Jawa, and Kalimantan regions. The Islamic financial development, GDP, and population variables can explain the diversity of environmental quality by 51.13%, while the remaining 48.87% is explained by other variables outside the model. But, in Sulawesi, the variables that have a significant impact on environmental quality are Islamic financial development and population which had a negative effect on environmental quality. In contrast, in Papua, the three variables had no significant effect on environmental quality.

5. DISCUSSION

5.1. The Effect of Islamic Financial Development on Environmental Quality in Member Regions

Based on Table 3, it showed that the Islamic financial development in Indonesia had a coefficient value of -0.00009 with a probability value of $0.079 <$ significance level of 10%, so it can be said that the Islamic financial development in Indonesia had a negative and significant effect on environmental quality in Indonesia. This indicated that increasing the Islamic financial development in Indonesia each period will reduce environmental quality in Indonesia by 0.00009 at a significance level of 10%. Likewise in the Sulawesi region, the Islamic financial development in Sulawesi had a coefficient of -0.02 with a probability value of $0.018 <$ significance level of 5%, so it can also be said that the Islamic financial development in Sulawesi had a negative effect and significantly on environmental quality in Sulawesi. It means that the increase in the Islamic financial development in Sulawesi every period will reduce the environmental quality in Sulawesi. In the areas of Sumatra, Jawa, Bali, Nusa Tenggara, and Kalimantan, the Islamic financial development also showed a negative effect but insignificant on environmental quality in the region, while in the Maluku and Papua regions, the Islamic financial development had a coefficient value of 0.01 with a probability value of 0.451, which means that the Islamic financial development in this region had a positive but insignificant effect on environmental quality in this region. Although in each region they were still different regarding the influence of Islamic financial development on environmental quality, overall, in the territory of Indonesia Islamic financial development had a significantly negative effect at a significant level of 10% on environmental quality.

Theoretically, Islamic financial development should have a significant and positive relationship to environmental quality because it refers to the sharia objective that Islamic financial institutions are prohibited from financing projects that harm the environment. However, in practice at this time, Islamic finance may not be in the ideal formation and implementation (Abduh et al., 2022). Although not significant, based on Table 3, Islamic financial developments in this study have the greatest influence on environmental quality. Similar to the results that there was a negative but not significant relationship between Islamic banking financing and air quality in Indonesia (Fatoni, 2021; Maulidiyah and Auwalin, 2021).

5.2. The Effect of GDP on Environmental Quality in Member Regions

Based on Table 3, it showed that the GDP in Indonesia had a coefficient value of $-6.E$-06 with a probability value of 0.000 < significance level of 5%, so it can be said that the GDP in Indonesia had a negative and significant effect on environmental quality in Indonesia. This indicated that increasing the GDP in Indonesia each period will reduce environmental quality in Indonesia by 6.E-06 at a significance level of 5%. Likewise in the Sumatera, Jawa, Bali, Nusa Tenggara, and Kalimantan region, the GDPs in each region had a negative coefficient with a probability value < significance level of 5%, so it can also be said that the GDPs in each region had a negative significant effect on environmental quality in each region. In the areas of Sulawesi, Maluku, and Papua, the GDP showed a positive effect but insignificant on environmental quality in each region, which means that the GDPs in each region of Sulawesi, Maluku, and Papua had a positive but insignificant effect on environmental quality in each region. Although in each region they also were still different regarding the influence of the GDPs on environmental quality, overall, in the territory of Indonesia, the GDP had a significantly negative effect at a significant level of 5% on environmental quality. This was in line that there are several reasons to support this view. Firstly, Islamic social finance, i.e. zakat, waqf, and charity, which focused on social inclusion or providing basic (staple) foods and necessities to the poorest community, will definitely create new demand for energy. Those poor people, who previously used less energy, now demand more such as electricity for lights and gas for cooking. Secondly, through its financial inclusion concepts, Islamic microfinance is lifting the social status of specific communities by providing them financial aid to run their businesses under the SMEs category, which raises the demand for energy significantly in the country. Thirdly, Islamic commercial banks via their intermediary financial function and Islamic capital markets are helping the business sector to improve their production capacity. This will obviously increase the level of national energy consumption (Abduh et al., 2022).

5.3. The Effect of Population on Environmental Quality in Member Regions

Based on the results in Table 3, in almost all regions of Indonesia, populations had a negative effect on environmental quality. However, it was insignificant, while it was only in Sulawesi that the population had a negative and significant effect at 5% on environmental quality because it had a coefficient value of -0.01 with a probability value of $0.047 <$ significance level of 5%. So, every increase in population each period will reduce environmental quality by 0.01 in Sulawesi. The size of the population will affect the emission of CO_2. This can happen because with the increasing population, the needs that must be met are increasing and with the increasing population, more activities will be carried out that result in environmental pollution (Islami et al., 2022).

5.4. Effect of Islamic Financial Development, GDP, and Population on Environmental Quality in Member Regions

Simultaneously, the Islamic financial development, GDP, and Population had a significant effect on environmental quality in all provinces in Indonesia and each of the regional groups. This can be seen based on the probability value on the F test <5% significance level. The goodness value of this analysis can be

seen from the Adjusted-R2 value, where in Indonesia, the resulted Adjusted-R2 value is 51.13%. This indicated that 51.13% of the diversity of environmental quality in Indonesia can be explained by Islamic financial development, GDP, and Population, while the rest of 48.87% was explained by other variables that were not explained in the model.

In the Kalimantan region, the resulting Adjusted-R2 value was 48.40%. This indicated that 48.40% of the environmental quality diversity in Kalimantan can be explained by Islamic financial development, GDP, and Population, while the remaining 51.6% was explained by other variables not explained in the model. In the Maluku and Papua regions, including the provinces of North Maluku and West Papua, the resulting Adjusted-R2 value was 41.29%. This indicated that 41.29% of the diversity of environmental quality in Kalimantan can be explained by Islamic financial development, GDP, and Population, while the remaining 58.71% is explained by other variables not described in the model. In Jawa, Bali, and Nusa Tenggara, the resulting Adjusted-R2 value was 35.36%. This indicated that 35.36% of the diversity of environmental quality in Kalimantan can be explained by Islamic financial development, GDP, and Population, while the remaining 64.64% was explained by other variables. Which were not described in the model. In the Sulawesi region, the resulted Adjusted-R2 value was 27.72%. This indicated that 27.72% of the environmental quality diversity in Kalimantan can be explained by Islamic financial development, GDP, and Population, while the remaining 72.28% was explained by other variables not explained in the model, while in Sumatra, the resulting Adjusted-R2 value was 21.93%. This indicated that 21.93% of the diversity of environmental quality in Kalimantan can be explained by Islamic financial development, GDP, and Population, while the remaining 78.07% was explained by other variables not explained in the model.

6. CONCLUSION

Simultaneously, the Islamic financial development, GDP, and Population had a significant effect on environmental quality in all provinces in Indonesia with 51.13% of the diversity of environmental quality in Indonesia can be explained by them. But partially, the Islamic financial development had a significantly negative effect at a significant level of 10% on environmental quality although in each region they were still different regarding the influence of the Islamic financial development on environmental quality. Like the GDP had a significantly negative effect at a significant level of 5% on environmental quality although in each region they also were still different regarding the influence of the GDPs on environmental quality. While in almost all regions of Indonesia, populations had a negative effect on environmental quality, it was insignificant, while it was only in Sulawesi that the population had a negative and significant effect at 5% on environmental quality.

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