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Investigating the Impact of FDI, Foreign Aid, and Islamic Capital Markets on Carbon Emission in ASEAN: The Moderating Role of Regulatory Quality

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A B S T R A C T

In the last few decades, member countries of ASEAN have experienced economic growth driven by increased FDI and FAID. However, the effect of this investment and foreign aid on carbon emissions in ASEAN countries is still not fully understood. This study examines the impact of FDI and FAID on carbon emissions in ASEAN countries, taking into account Regulatory Quality as a moderator. Panel data from 2011 to 2021 was collected using purposive sampling. The results show that FDI significantly and positively affects carbon emissions, while FAID does not show a significant effect. In contrast, the Islamic capital market shows a significant and negative impact on carbon emissions, demonstrating its potential to reduce emissions in ASEAN countries. Regulatory Quality moderates the relationship between FAID and carbon emissions in a positive way. This study recommends strengthening environmental regulations to mitigate the negative effects of FDI while promoting socially and environmentally responsible Islamic capital markets in ASEAN countries. Further research is needed to understand the factors influencing this relationship comprehensively.

Keywords: *Carbon Emissions; Foreign Aid; Foreign Direct Investment; Islamic Capital Market.*

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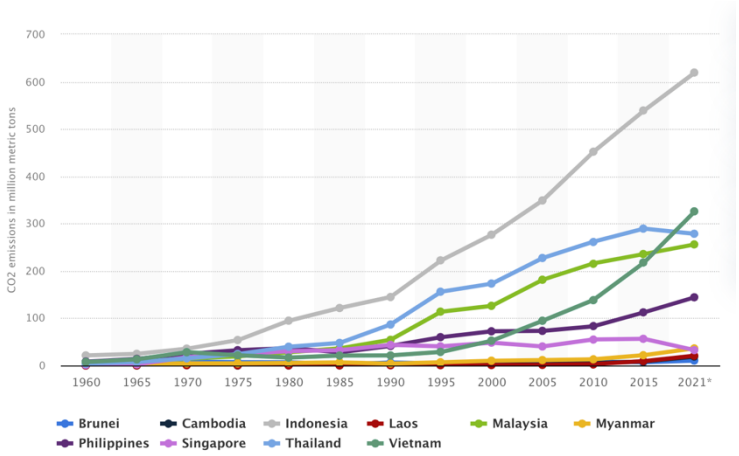
INTRODUCTION

Carbon emission is a global environmental issue that urgently needs to be addressed. High levels of carbon emissions can cause serious climate change and have negative impacts on people and ecosystems. In an effort to reduce carbon emissions, countries around the world have been trying to find effective solutions. In the context of ASEAN countries such as Indonesia, Malaysia, Singapore, Thailand, and the Philippines, two factors that may influence carbon emissions are Foreign Investment (FDI) and Foreign Assistance (Foreign Aid) given to these countries. In addition, the quality of regulations in these countries can also moderate the influence of FDI and Foreign Assistance on carbon emissions (Apergis et al., 2023).

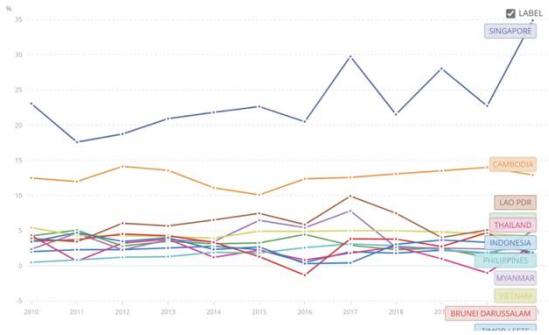
Total carbon emissions in ASEAN countries increased from 1,293 million metric tons of CO2 in 2010 to 1,601 million metric tons of CO2 in 2021. The ASEAN countries that emit the most carbon in 2021 are Indonesia (619 million metric tons of CO2), Thailand (279 million metric tons of CO2), and Vietnam (276 million metric tons of CO2). The average per capita carbon emission in ASEAN countries is around 4 metric tonnes of CO2 per person by 2021. Overall ASEAN carbon emissions are increasing over time. Rapid economic growth, urbanization, and increased industrial and transportation activities are all contributing factors to increasing carbon emissions in the region. In recent years, several ASEAN countries have made efforts to reduce carbon emissions through environmental protection policies and measures (Statista, 2023).



Source: Statista, 2023

Figure 1. Territorial carbon dioxide (CO2) emissions in Southeast Asia from 1960 to 2021, by country (in million metric tons of CO2)

This study discusses several factors that have the potential to affect carbon emissions, such as Foreign Direct Investment (FDI) which can have a multiple impact on carbon emissions.

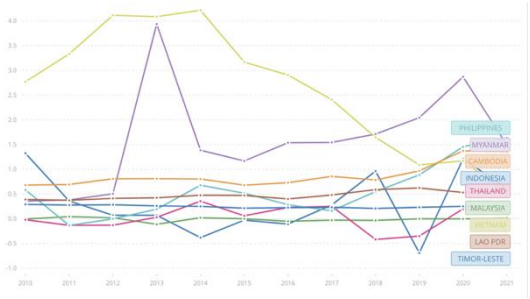


Source: World Development Indicators, 2023

Figure 2. Inflows of Foreign Direct Investment in ASEAN Countries

On the one hand, FDI can help improve energy efficiency and production technology in the industrial sector, which in turn can reduce carbon emissions. On the other hand, FDI can also promote higher economic growth, which may have a negative impact on the level of carbon emissions. Therefore, it is important to understand how FDI affects carbon emissions in ASEAN Countries (Auzairy et al., 2018).

FDI fluctuations in ASEAN countries occur in the 2010-2021 timeframe. Based on World Bank data1, net FDI as a share of GDP experienced the highest increase in 2012 with an average of 5.3%. However, this figure decreased to an average of 3.4% in 2019. As a result of the COVID-19 pandemic in 2020, net FDI in ASEAN countries fell further to an average of 2.6% of GDP. Data for 2021 is not yet available. In 2020, the ASEAN countries receiving the largest net FDI as a percentage of GDP are Singapore (18%), Vietnam (3%) and Cambodia (2.8%). Meanwhile, the ASEAN countries that received the smallest percentage of net FDI in 2020 were Brunei Darussalam (-1%), Indonesia (-0.5%), and Malaysia (-0.4%) (UNCTAD, 2021).



Source: World Development Indicators, 2023

Figure 3. Net official development assistance received by ASEAN countries

Foreign aid received by ASEAN countries increased from 2010 to 2021. According to the World Bank, the amount of net aid received by ASEAN countries increased from USD 9.8 billion in 2010 to USD 12.8 billion in 2021. Vietnam , Myanmar, and Indonesia are ASEAN countries that receive the most assistance in 2021, while Singapore, Brunei Darussalam, and Malaysia receive the least assistance that year (Bank, 2021).

Foreign Aid can play a role in promoting sustainable development and reducing carbon emissions in ASEAN Countries. Foreign aid can be used to finance green infrastructure projects, renewable energy development, and green technology transfer. However, the effectiveness of Foreign Assistance in reducing carbon emissions can also be affected by the quality of regulation in the recipient country (Mahalik et al., 2021).

In addition, the Sharia Stock Index is a stock market index that measures the performance of companies that comply with sharia principles (Fitriyanto et al., 2021). Sharia Stock Indices can affect economic activities and investment in ASEAN countries, and therefore may also have an impact on carbon emissions (Romadhon & Ardiansyah, 2022).

This Sharia Stock Index in ASEAN countries reflects the commitment to implement sharia principles in economic and investment activities. This index provides guidance for companies in carrying out business practices that comply with sharia principles, including environmental aspects. By applying sharia principles in economic and investment activities, it is hoped that harmony will be created between economic development and environmental protection (Farooq et al., 2020).

Good regulatory quality can increase the effectiveness of FDI and Foreign Aid in reducing carbon emissions. Strict and consistent regulations can encourage foreign companies to adopt environmentally friendly production practices and reduce carbon emissions. In addition, good regulatory quality can also ensure that Foreign Aid is used effectively and efficiently to reduce carbon emissions (Huang et al., 2022).

In the context of ASEAN countries such as Indonesia, Malaysia, Singapore, Thailand and the Philippines, two factors that might affect carbon emissions are Foreign Direct Investment (FDI), Foreign

Aid and the Islamic Capital Market in ASEAN. In addition, the quality of regulations in these countries can also moderate the effect of FDI and Foreign Aid on carbon emissions. Previous research has investigated the effect of FDI and Foreign Aid on carbon emissions separately (Mahendra et al., 2022). However, there is still a need to understand how these factors interact in the context of ASEAN Countries and how the quality of regulations influences their impact on carbon emissions. Therefore, this study aims to investigate the relationship between FDI, Foreign Aid, regulatory quality, and carbon emissions in ASEAN Countries.

Several relevant studies have been conducted, such as the research from Mahendra et al., (2022) found that in ASEAN countries (Indonesia, Malaysia, Singapore, Thailand, Philippines, Brunei Darussalam, Vietnam, Myanmar and Cambodia) foreign direct investment (FDI) has a positive and significant effect on carbon dioxide emissions, while control of corruption has a negative and significant effect on carbon dioxide emissions. So is research from Huang et al., (2022) to investigate the impact of FDI inflows on carbon emissions, and further explore the channels of influence through the moderating effects of economic development and regulatory quality to investigate the impact of FDI inflows on carbon emissions, and further explore the channels of influence through the moderating effects of economic development and Regulatory Quality. They find that FDI inflows are positively related to carbon emissions, and that economic development and the quality of regulation contribute negatively to the impact of FDI inflows on carbon emissions. This implies that while FDI inflows tend to increase carbon dioxide emissions, they are more likely to reduce carbon emissions in countries with a higher level of economic development and quality of regulation. But research from Song et al., (2021) having a two-way impact means that FDI can cause a lot of carbon emissions and can also inhibit carbon emissions. So that steps are needed to promote a "green" revolution in FDI utilization patterns, mechanisms for interaction between FDI and low-carbon economic development so that this can inhibit carbon emissions.

Although research from Demena & Afesorgbor, (2020) found that FDI significantly reduces environmental emissions. These results remain robust after disaggregating the effects for countries at different levels of development and also for different pollutants. despite the dominant negative view of the impact of FDI on the environment, research shows that FDI also has the potential to reduce emissions and contribute to a cleaner environment, especially when supported by green technologies.

Amin et al., (2018) found that foreign aid reduced energy consumption and carbon intensity in Bangladesh. Likewise, according to the Islamic capital market Nazir & Khan, (2013) Islamic capital markets play an important role in reducing carbon emissions. The Islamic capital market operates based on Islamic principles which prohibit investment in sectors that have the potential to damage the environment. In other words, Islamic capital markets tend to invest in companies that focus on socially and environmentally responsible business practices. Although in fact the development of the stock market has a different effect on carbon emissions. This means that fluctuations and changes in the stock market can affect carbon emissions in ways that are neither linear nor balanced. Positive and negative shocks to stock market indicators reduce environmental quality by increasing carbon emissions. This indicates that the development of the stock market, especially in emerging markets, can encourage an increase in carbon emissions that are detrimental to the environment (Mhadhbi et al., 2021; Alifiani & Suryaningrum, 2020).

There are deficiencies in previous research. The article only focuses on the influence of FDI, Foreign Aid and the Islamic Capital Market separately, without considering the interaction between the two. In addition, previous research has not specifically focused on ASEAN countries. This study aims to fill this gap. By analyzing the effect of FDI, Foreign Aid and Islamic Capital Markets on carbon emissions in ASEAN countries and considering the quality of regulation as a moderator, this research is expected to provide a more comprehensive understanding of the interaction and influence of these factors on carbon emissions in developing countries. ASEAN.

This research has an important contribution to our understanding of the relationship between FDI, Foreign Aid, Islamic Capital Markets, regulatory quality, and carbon emissions in ASEAN Countries. The findings of this study can provide new insights for policy makers, practitioners and researchers in designing effective carbon emission reduction strategies in these countries. In addition, this research can help raise awareness about the importance of regulatory quality in achieving sustainable development goals.

LITERATURE REVIEW

Pollution Haven Theory

According to Levinson & Taylor, (2008) The Pollution Haven Theory which states that countries with low environmental regulations can attract foreign direct investment (FDI) because they can offer cheaper production costs. However, this can have a negative impact on the environment because FDI can increase carbon emissions due to the use of technologies and fuels that are not environmentally friendly. This theory assumes that developing countries tend to sacrifice the environment for economic growth.

Environmental Kuznets Curve (EKC)

The first time the Environmental Kuznets Curve theory was introduced by Kuznets, (1955) that this theory describes the relationship between economic progress and environmental conditions. This theory shows the relationship in the form of an inverted U-shaped curve, which means that in the early stages of economic progress it will cause environmental pollution, but after passing a certain point, economic progress will reduce environmental pollution. This certain point depends on various factors, such as income levels, people's preferences, and government regulations. This theory assumes that economic progress will lead to changes in people's choices, technology, and economic structure, which will have an impact on emission levels and environmental influences (Grossman & Krueger, 1991).

Corporate Social Responsibility Theory

Howard R. Bowen (1953) revealed the Corporate Social Responsibility Theory which conveys that companies have a responsibility to pay attention to the social and environmental impacts of their operations. In the context of the Islamic capital market, companies that follow Islamic principles tend to have a higher commitment to social and environmental responsibility, which can contribute to reducing carbon emissions. This theory assumes that companies do not only aim to make a profit, but also to provide benefits to society and the environment.

Regulatory Compliance Theory

According to Kagan & Scholz, (1984) Regulatory Compliance Theory is a theory that explains that high regulatory quality can affect company compliance with environmental standards and limit behavior that is detrimental to the environment, including carbon emissions. This theory is based on the assumption that companies will comply with regulations if the benefits outweigh the costs. This theory emphasizes the important role of government in making and enforcing effective environmental regulations.

Foreign Direct Investment

Foreign Direct Investment (FDI) refers to equity investments abroad made by private multinational companies. FDI is a form of investment that involves multinational companies in expanding their business activities to other countries. This investment involves the ownership of shares by a foreign company in a company operating in the host country. Through FDI, multinational companies can gain significant ownership and influence the strategies and decisions of the companies they invest in. These investments are usually made with the aim of expanding markets, utilizing natural resources, acquiring new technology and knowledge, as well as optimizing production and distribution efficiency. In the context of economic globalization, FDI has become an important factor in economic integration between countries and overall economic growth (Todaro & Smith, 2013).

FDI can increase carbon emissions due to the use of technologies and fuels that are not environmentally friendly. Based on the Pollution Haven Theory which states that countries with low environmental regulations can attract foreign direct investment (FDI) because they can offer cheaper production costs. However, this can have a negative impact on the environment because FDI can increase carbon emissions due to the use of technologies and fuels that are not environmentally friendly. This theory assumes that developing countries tend to sacrifice the environment for economic growth (Levinson & Taylor, 2008).

This theory is in line with some of the findings of previous studies, such as from (Mahendra et al., (2022) hat foreign direct investment (FDI) has a positive and significant effect on carbon dioxide

emissions, a role for control of corruption is needed to control the positive effect FDI on carbon emissions. The same result also from (Huang et al., 2022) that FDI inflows are positively related to carbon emissions, so policy makers need to formulate effective policies to help reduce carbon emissions and eliminate environmental degradation. Research from Apergis et al., (2023) found that FDI flows to BRICS countries from Denmark and the UK increased carbon emissions in BRICS countries, this confirms the Pollution Haven Theory. Similar things from research by Mahalik et al., (2021), Auzairy et al., (2018) dan Farooq et al., (2020), that foreign direct investment (FDI) has a positive effect on carbon emissions, which means that foreign direct investment (FDI) increases carbon emissions.

H_1: Foreign Direct Investment has a positive effect on carbon emissions

Foreign Aid

Foreign Aid is a form of international transfer of funds in the form of loans or grants made by state governments with the aim of helping recipient countries. These transfers can be made directly between one government and another, which is called bilateral assistance, or through multilateral aid agencies such as the World Bank. This assistance aims to meet the financial needs of recipient countries and encourage economic and social development in these countries. Foreign Aid has an important role in strengthening cooperation between countries and assisting countries in need in overcoming resource gaps. This assistance can be in the form of loans that must be returned with interest or grants that do not need to be returned. With the existence of foreign aid, recipient countries can obtain the resources needed to carry out development projects, improve the quality of life of the people, and overcome the social and economic problems they face (Todaro & Smith, 2013). The Keynesian economic growth model (Domar, 1946; Harrod, 1939) analyzes the importance of foreign aid in capital formation and domestic investment by closing the savings gap, thus accelerating the economic growth of developing countries (Golder et al., 2021).

Foreign Aid may face pressure from donor countries to serve their economic interests. In an effort to meet donor country requirements and expectations, recipient countries may tend to ignore or reduce efforts to reduce carbon emissions, which can result in negative impacts on the environment (Frank, 1966).

Environmental Kuznets Curve (EKC) theory from Kuznets (1955) assumes that in the early stages of economic growth, carbon emissions will increase along with increased industrial activity and energy consumption. However, at later stages of economic growth, carbon emissions will decrease as technology advances, changes in economic structure, and increases environmental awareness. This theory can explain that Foreign Aid can affect carbon emissions through international trade. Foreign Aid can help recipient countries to reach a stage of economic growth where carbon emissions start to fall. This can happen if Foreign Aid is used to increase investment in clean technology, reduce dependence on fossil energy sources, and encourage diversification of economic sectors that are more environmentally friendly. In addition, Foreign Aid can also assist recipient countries to participate in international trade agreements that establish environmental standards and payment mechanisms for environmental services (Grossman & Krueger, 1991).

Research from Mahalik et al., (2021) found that foreign aid flows, globalization, and energy consumption significantly reduced CO2 emissions, while foreign energy aid flows, economic growth, FDI, and remittance flows actually increased CO2 emissions. Likewise, from Kretschmer et al., (2011) dan Amin et al., (2018) Foreign Aid tends to be effective in reducing the energy intensity of GDP (Gross Domestic Product) in recipient countries. This means that Foreign Aid can help improve energy efficiency in these countries. However, there is an interesting finding that the carbon intensity of energy use is almost unaffected by foreign aid.

H_2: Foreign Aid has a negative effect on carbon emissions

Islamic Capital Market

The Islamic Capital Market is a capital market that adheres to Sharia principles, this market brings together people, investors, companies and governments who have excess funds to transfer them to people, companies or governments who lack funds. The Islamic capital market functions as a financial intermediary by channeling funds from surplus units to deficit units, functioning as a parallel market with conventional

capital markets for capital seekers and capital providers. The Islamic capital market attracts funds from both domestic and international sources. The Islamic Capital Market is part of the Islamic Financial System where financial assets complying with Sharia principles are traded. The Islamic capital market plays a central role in the growth of Islamic Financial Institutions (Alam et al., 2017).

Howard R. Bowen (1953) argues that Corporate Social Responsibility Theory conveys that companies have a responsibility to pay attention to the social and environmental impacts of their operations. In the context of the Islamic capital market, companies that follow Islamic principles tend to have a higher commitment to social and environmental responsibility, which can contribute to reducing carbon emissions. This theory assumes that companies do not only aim to make a profit, but also to provide benefits to society and the environment.

This theory is supported by findings from Nazir & Khan, (2013) Islamic capital markets can play an important role in reducing carbon emissions. The Islamic capital market operates based on Islamic principles which prohibit investment in sectors that have the potential to damage the environment. In other words, Islamic capital markets tend to invest in companies that focus on socially and environmentally responsible business practices. Research findings from Mhadhbi et al., (2021) which reveal that positive and negative impacts on stock market development indicators have different effects on carbon emissions. This means that fluctuations and changes in the stock market can affect carbon emissions in a way that is not linear or balanced, they suggest that policy makers implement strong environmental policies in emerging countries to reduce carbon emissions from industrial companies without hindering the development of financial markets.

H_3: Islamic Capital Market has a Negative Effect on Carbon Emissions

Regulatory Quality

Regulatory quality refers to the level of excellence and effectiveness of regulations applied in a government system. This includes the quality of regulations, decision-making processes, application of laws, transparency, accountability, and the ability of governments to properly manage and enforce regulations. In a broader context, regulatory quality reflects the ability of a country or institution to create and operate a regulatory environment that promotes sustainable economic growth, consumer protection, social justice, environmental sustainability, and financial stability. Assessment of regulatory quality includes an evaluation of the accuracy, consistency, and efficiency of regulations, as well as the ability of the government system to implement and enforce these regulations effectively and fairly. A high level of regulatory quality is expected to create a healthy business climate, increase investment, and encourage innovation, while ensuring fair risk protection and societal interests (Radaelli & Francesco, 2011).

According to Kagan & Scholz, (1984) Regulatory Compliance Theory is a theory that explains that high regulatory quality can affect company compliance with environmental standards and limit behavior that is detrimental to the environment, including carbon emissions. This theory is based on the assumption that companies will comply with regulations if the benefits outweigh the costs. This theory emphasizes the important role of government in making and enforcing effective environmental regulations.

Research from Huang et al., (2022) that although FDI inflows can increase carbon emissions, the impact will be lower in countries with a better level of economic development and regulatory quality. That is, good economic development and quality regulation can reduce the negative impact of FDI inflows on carbon emissions. These findings provide valuable information for policy makers in designing effective policies to reduce carbon emissions and protect the environment. Thus, measures to enhance economic development and improve the quality of regulation can contribute to addressing the problem of carbon emissions that are often associated with FDI inflows.

Findings from Mahalik et al., (2021) that there is a relationship between foreign aid and carbon emissions, and provide important input for policy makers in formulating effective policies to reduce carbon emissions and improve environmental quality. Kono & Montinola (2019) have the same opinion that good policies/regulations are needed so that foreign aid on the climate can be more effective and reduce carbon emissions.

H_4: Regulatory Quality strengthens the negative relationship of Foreign Direct Investment to Carbon Emissions
H_5: Regulatory Quality strengthens the negative relationship of Foreign Aid to Carbon Emissions

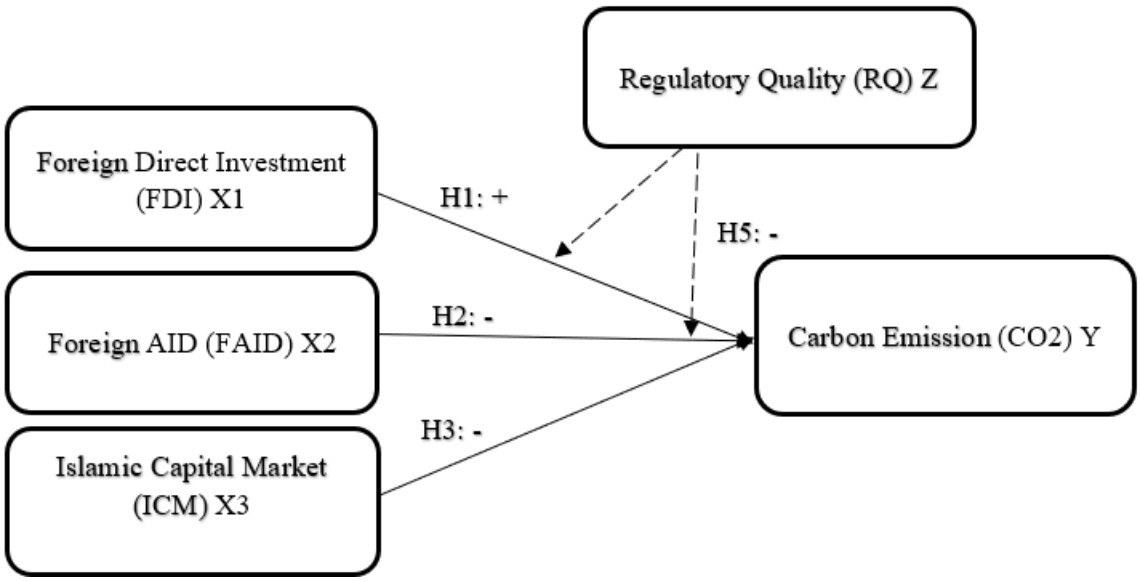


Figure 4. Framework

RESEARCH METHOD

Data Types and Sources

In this study, secondary data is used with the type of data, namely panel data. This research data comes from the World Bank, United Nations Development Program (UNDP), Our World in Data, Yahoo Finance and Investing.com as well as various other official website sources that support this research, In this study used secondary data with the type of data that is panel data. This research data comes from the World Bank, United Nations Development Program (UNDP), Our World in Data, Yahoo Finance and Investing.com as well as various other official website sources that support this research with an observation period of 11 years starting from 2011 to 2021.

Population and Sample

The population is a complete group of elements and is usually in the form of people, objects, transactions or events where we are interested in making the object of research (Kuncoro, 2013). In this study the population used is ASEAN countries. The sample is representative of the entire population because the sample is taken from a portion of the population for research (Sekaran & Bougie, 2016). This study uses a purposive sampling method with consideration of countries from ASEAN which have complete data starting from Foreign AID, FDI, Islamic Capital Markets and Regulatory Quality for eleven years. For Islamic capital market data in ASEAN found ISSI Indonesian Sharia Stock Index, FTSE Exchange Malaysia EMAS Shariah (FTFBMS) and FTSE SET Shariah (FTFSTSH) Thailand, the four stock indices represent each country sampled in this study.

Operational definition

Carbon Emission: Greenhouse gas emissions in CO2 equivalents refer to the total amount of various greenhouse gases emitted into the atmosphere, converted into an equivalent amount of carbon dioxide (CO2) based on their global warming potential over a specific time frame, often 100 years. This measurement standard allows us to compare the impact of different greenhouse gases on the climate by expressing their warming effect in terms of the common reference gas, CO2 (Ritchie et al., 2020).

Greenhouse gas emissions in CO2 equivalents are calculated using the following formula:

$$Total\ Emissions\ in\ CO2\ equivalents = \Sigma\ (Emissions\ of\ Gas\ i \times Global\ Warming\ Potential\ of\ Gas\ i)$$

Where:

Σ is the summation symbol from *I* =1 to *n*, where *n* is the number of different greenhouse gases being considered.

Emissions of Gas *i* is the amount of greenhouse gas *i* emitted, usually measured in metric tons.

Global Warming Potential of Gas *i* is the factor representing how much more heat a specific gas can trap in the atmosphere compared to carbon dioxide (CO2) over a designated time period (usually 100 years).

This formula allows the emissions of various greenhouse gases to be quantified in a single unit, namely CO2 equivalents. It provides a standardized and comparable approach to assessing their impact on global warming.

Foreign Direct Investment (FDI): The amount of direct investment made by foreign investors in the form of capital, technology, and skills in a country. To measure it, you can use data provided by government agencies such as the World Bank or foreign investment institutions. The FDI value is calculated in US Dollars (US$), and this unit represents the amount of foreign investors' direct investment entering a country in the form of US dollars (Todaro & Smith, 2013).

Foreign Aid: The amount of aid provided to the eight developing countries in this study. Data sources can be found on the website of the OECD Development Assistance Committee (DAC), which is the organization for economic cooperation between countries and can be quantified using annual data in US Dollar (US$) units available on the OECD DAC website (Todaro & Smith, 2013).

Islamic Capital Market (ICM) is an important part of the Islamic Financial System in which financial assets are traded according to Sharia principles. To obtain opening price data, we use data sources from investing.com and Yahoo Finance. ICM has a major role in the growth of Islamic Financial Institutions, In this research, we measure the ICM using performance data from Sharia stock indices in each ASEAN country for respective years. (Alam et al., 2017).

Regulatory quality is the capacity of the government to formulate and implement policies and regulations that support and encourage the growth of a productive and just private sector. Regulatory quality includes aspects such as openness, accountability, involvement, uniformity, performance, and results of the regulatory process. Regulatory quality also includes the level of protection of property rights, freedom of transaction, legal certainty, and proportional and impartial treatment for business actors. Regulatory quality is measured using indicators derived from various data sources such as business and expert opinion surveys, economic freedom index, ease of doing business index, regulatory quality index, and others (Kaufmann et al., 2010).

Analysis Techniques

The data collected was then analyzed using the eviews 10 application. The panel data in this study included cross sectional data from 5 ASEAN countries. And the time series data covers the years 2011-2021. The relationship between the dependent variable Carbon Emissions (Y) and the independent variables in the form of Foreign Direct Investment (X1), Foreign Aid (X2), Islamic Capital Markets (X3) and moderated by Regulatory Quality (Z) will be explained in this study. This research was conducted in several stages. The researcher conducted a model selection test which consisted of the Chow test which was used to determine between Pooled Least Square (PLS)/ Common Effect and Fixed Effect, further the Hausman test which was used to determine between Random Effect and Fixed Effect. In the last stage is testing the hypothesis and to find out the results of moderation using Moderated Regression Analysis (MRA).

Moderate Regression Analysis (MRA) Test equation model

(1) $Y = \alpha + \beta 1.FDI + \beta 2.FAID + \beta 3.ICM + \beta 4.RQ + e$

(2) $Y = \alpha + \beta 1.FDI + \beta 2.FAID + \beta 3.ICM + \beta 4.RQ + \beta 5.FDI\,RQ + \beta 6.FAID\,RQ + e$

Where:

Y	= Carbon Emission
a	= Constant
b_1-b_6	= Regression Coefficient
FDI	= Foreign Direct Investment
FAID	= Foreign Aid
ICM	= Islamic Capital Market
RQ	= Regulatory Quality
e	= Error Term, or the error rate of the inner estimator study

RESULTS AND DISCUSSION

Result

Descriptive Statistics

Based on table 2, the average value of Carbon Emission in ASEAN during the period 2011 to 2021 in terms of metric tons of CO2 equivalent is approximately 34.62 tons. This means that the average amount of carbon dioxide (CO2) emissions released by ASEAN countries is around 34.62 tons.

Table 1. Descriptive Statistics

	CARBON	FDI	FAID	ICM	RQ
Mean	34,62331261	11,369,860,591	196,369,772.8	214,50	58,48
Median	33,981651	9,902,880,468	49,739,999.5	134,54	56
Standard Deviation	12,43878716	7,022,462,394	465,836,039	271,54	8,63
Minimum	16,838278	-4,947,474,467	-690,000,000	1,040	41
Maximum	54,460326	25,120,732,060	1,630,000,000	995,65	76
Observation	44	44	44	44	44

Source: Data processed Eviews 10, 2023.

The average value of Foreign Direct Investment (FDI) is 11,369,860,591 or 11.37 billion USD. The highest amount reaches 25,120,732,060 or 25.12 billion USD, while the lowest amount is -4,947,474,467 or -4.95 billion USD. This indicates that the lowest recorded Foreign Direct Investment inflow in the D-8 countries in this study is approximately -4.95 billion USD during the period 2011 to 2021. On the other hand, the average value of Foreign Direct Investment in the D-8 countries during that period is 11.37 billion USD, which is higher than the standard deviation of 7.02 billion USD.

The average value of Foreign Aid (FAID) in ASEAN is 196,369,772.8 or 196.37 million USD. The highest amount reaches 1,630,000,000 or 1.63 billion USD, while the lowest amount is 690,000,000 or -690 million USD. This indicates that the average inflow of foreign aid in the D-8 countries during the period 2011-2021 is approximately 196.37 million USD.

The average value of the Islamic Capital Market in ASEAN is about 214.50. This suggests that overall, the value of the Islamic stock index in ASEAN countries tends to fall within that range. The maximum value of 995.65 indicates the highest value of the Islamic Capital Market in ASEAN. This indicates that there are countries with the highest Islamic stock index values in the studied period. Meanwhile, the lowest value of 1.04 shows the smallest value of the Islamic Capital Market in ASEAN.

The average value of Regulatory Quality in ASEAN is 58.48%. This indicates that the average quality of regulations in ASEAN countries during the period 2011-2021 is approximately 58.48%. The highest value reaches 76%. Meanwhile, the lowest value of Regulatory Quality is around 41%. This indicates that there are countries in the ASEAN region facing challenges in ensuring effective regulations that support economic development.

Langrange Multiplier Test

Based on the data listed in the Table 2, it is found that the P-Value indicated by the figure below is 0.0579, which is greater than the specified significance level of 0.05. Therefore, the results of the Lagrange Multiplier Test indicate that the best estimation method that can be used in this context is the Common Effect. In this context, Common Effect is considered as an estimation method that is more suitable and consistent with the existing data. This shows that there is a significant common effect on the model being tested, so that this method can provide more accurate and reliable results in further analysis.

Table 2. Langrange Multiplier Test Results

Lagrange Multiplier Tests for Random Effects
Null hypotheses:No effects
Alternative hypotheses:Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Cross-section	Test Hypothesis Time	Both
Breusch-Pagan	3.597898	0.007528	3.605426
	(00.579)	(09.309)	(00.576)
Honda	1.896.813	0.086.766	1.402.602
	(00.289)	(04.654)	(00.804)
King-Wu	1.896.813	0.086.766	1.755.294
	(00.289)	(04.654)	(00.396)
Standardized Honda	1.287.446	0.166.959	-1.012.937
	00.000	(04.337)	(08.445)
Standardized King-Wu	1.287.446	0.166.959	0.769.620
	00.000	(04.337)	(02.208)
Gourieroux, et al.			3.605.426
			(00.700)

Source: Data processed Eviews 10, 2023

Multiple Regression Test

The results of the calculation of the effect of the moderating variable on regulatory quality obtained the Prob value. = 0.0183 > 0.1 then H4 is rejected (see Table 3). This gives the conclusion that political stability has not been able to influence a strong relationship between foreign direct investment on carbon emissions. The moderation type on these outcomes is the Moderation Predictor.

Moderated Regression Analysis (MRA) Test

Hypothesis 5 test: Political stability strengthens the relationship between Foreign Aid and Carbon Emissions (Table 4).

The results of the calculation of the influence of the moderating variable on political stability obtain the Prob value. = 0.1008 < 0.1 then H5 is accepted with a coefficient value of the results of this moderation of 0.074 which can illustrate the positive influence of Regulatory quality as a moderation on the relationship between foreign aid and carbon emissions. The type of moderation in this result is Quasi Moderation which means that the variable that moderates the relationship between the predictor variable and the dependent variable is where the pseudo variable interacts with the predictor variable as well as being a predictor variable.

Table 3. Multiple Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Cc	1,83E+9	6,51E+8	2,808528	0,0088
FDI	0,075864	0,012960	5,853933	0,0000
ODA	-0,093696	0,179383	-0,522325	0,6054
ICM	-6251,796	3606,409	1,733524	0,0936
RQ	-28227328	9227653.	-3,058993	0,0047
R-squared	0,710596	Mean dependent var		8,99E+8
Adlusted R-squared	0,670678	$.D. dependent var		8,21E+8
S.E. of regression	4,71E+8	Akaikeinfo criterion		42,91403
Sum squared resid	6,44E+18	Schwarzcriterion		43,13850
Loglikelihood	-724,5386	Hannan-Quinn criter.		42,99058
F-statistic	17,80147	Durbin-Watson stat		0,965459
Prob(F-statistic)	0,000000			

Source: Data processed Eviews 10, 2023

Table 4. Moderated Regression Analysis (MRA) Test Results

Variable	Coefficient	Std. Error	—_t-Statistic	Prob.
Cc	2,17E+9	6,47E+8	3,349942	0,0024
FDI	0,072311	0,012538	5,767173	0,0000
ODA	-4,833206	2,523106	-1,915578	0,0661
ICM	+5481,163	3784,211	-1,448430	0,1590
RQ	-32976177	9158450.	-3,600629	0,0013
FDI_RQ	3,62E-11	2,65E-11	1,365460	0,1834
ODA_RQ	0,074835	0,044039	1,699291	0,1008
R-squared	0,753058	Mean dependent var		8,99E+8
Adusted R-squared	0,698182	S.D. dependent var		8,21E+8
of regression	4,51E+8	Akaikeinfo criterion		42,87301
Sum squaredresid	5,49E+18	Schwarz criterion		43,18726
Loglikelihood	-721,8412	Hannan-Quinn criter.		42,98018
F-statistic	13,72288	Durbin-Watsonstat		1,097164
Prob(F-statistic)	0,000000			

Source: Data processed Eviews 10, 2023

Discussion

Based on the results of the analysis it was found that foreign direct investment has a positive effect on carbon emissions, this indicates that foreign direct investment received in ASEAN countries can increase the amount of carbon emissions to recipient countries. This result is in line with the Pollution Haven Theory which states that countries with low environmental regulations can attract foreign direct investment (FDI) because they can offer cheaper production costs. However, this can have a negative impact on the environment because FDI can increase carbon emissions due to the use of technologies and fuels that are not environmentally friendly. This theory assumes that ASEAN developing countries tend to sacrifice the environment for economic growth (Levinson & Taylor, 2008).

These results are also evidenced by the findings of Mahendra et al., (2022) that foreign direct investment (FDI) has a positive and significant effect on carbon dioxide emissions, a control role is needed to control the positive effect of FDI on carbon emissions. The same result is also from (Huang et al., 2022) that FDI inflows are positively related to carbon emissions, so policy makers need to formulate effective policies to help reduce carbon emissions and eliminate environmental degradation. Research from Apergis et al., (2023) found that FDI flows to BRICS countries from Denmark and the UK increased

carbon emissions in BRICS countries, this confirms the Pollution Haven Theory. Similar thing from research by Mahalik et al., (2021), Auzairy et al., (2018) dan Farooq et al., (2020), that foreign direct investment (FDI) has a positive effect on carbon emissions which means that foreign direct investment (FDI) increases carbon emissions.

Whereas for foreign aid or aid funds from abroad for ASEAN countries it does not actually affect the carbon emissions produced by the recipient country. This is not in accordance with the theory of the Environmental Kuznets Curve (EKC) from Kuznets, (1955) that foreign aid can affect carbon emissions through international trade. Foreign Aid can help recipient countries to reach a stage of economic growth where carbon emissions start to fall. This can happen if foreign aid is used to increase investment in clean technology, reduce dependence on fossil energy sources, and encourage diversification of economic sectors that are more environmentally friendly. In addition, foreign aid can also help recipient countries to participate in international trade agreements that establish environmental standards and payment mechanisms for environmental services (Grossman & Krueger, 1991).

In contrast to the Islamic capital market which has a negative significant effect on carbon emissions, this indicates that an increase in the Islamic capital market can reduce the amount of carbon emissions in ASEAN countries. This is in line with the theory of Howard R. Bowen (1953) that Corporate Social Responsibility Theory companies have a responsibility to pay attention to the social and environmental impacts of their operations. In the context of the Islamic capital market, companies that follow Islamic principles tend to have a higher commitment to social and environmental responsibility, which can contribute to reducing carbon emissions. This theory assumes that companies do not only aim to make a profit, but also to provide benefits to society and the environment.

These findings are supported by the results of research by Nazir & Khan, (2013) that the Islamic capital market can play an important role in reducing carbon emissions. The Islamic capital market operates based on Islamic principles which prohibit investment in sectors that have the potential to damage the environment. In other words, Islamic capital markets tend to invest in companies that focus on socially and environmentally responsible business practices. Likewise the research findings from Mhadhbi et al., (2021) which revealed that positive and negative impacts on stock market development indicators have different effects on carbon emissions. This means that fluctuations and changes in the stock market can affect carbon emissions in a way that is not linear or balanced, they suggest that policy makers implement strong environmental policies in emerging countries to reduce carbon emissions from industrial companies without hindering the development of financial markets.

This study also examines how regulatory quality strengthens the relationship between foreign direct investment and foreign aid on carbon emissions, and it is found that regulatory quality can only influence foreign aid on carbon emissions with a positive effect. This finding is unique because of the good regulatory qualities of the juice actually making foreign aid increase the amount of carbon emissions in ASEAN countries.

In this situation, when ASEAN countries receive foreign aid (Foreign Aid) amidst the existence of good regulatory quality, the effect of this assistance can lead to an increase in carbon emissions. This phenomenon can be influenced by various factors that were not included in this study. This finding provides a unique and interesting aspect because it is usually expected that foreign aid will play a role in reducing carbon emissions and supporting sustainable development. However, in this context, good regulatory quality can actually strengthen the negative impact of foreign aid on carbon emissions.

CONCLUSION

This study shows that Foreign Direct Investment (FDI) has a positive influence on carbon emissions in ASEAN countries, according to the Pollution Haven Theory. This implies that foreign investment can increase the amount of carbon emissions in the receiving country, because weak environmental regulations attract investment with lower production costs. However, foreign aid (Foreign Aid) has no significant effect on carbon emissions in ASEAN countries, not in accordance with the Environmental Kuznets Curve (EKC) theory. This may be caused by other factors not considered in this study. On the other hand, the Islamic capital market has a significant negative effect on carbon emissions in ASEAN

countries, according to the theory of Corporate Social Responsibility. This shows that improving the Islamic capital market can help reduce carbon emissions through principles that promote social and environmental responsibility.

The next finding is that regulatory quality only affects the relationship between foreign aid and carbon emissions with a positive effect. This is interesting because good regulatory quality actually increases carbon emissions through foreign aid in ASEAN countries. These findings indicate the need to consider factors not covered in this study. Further research needs to be conducted to fully understand the factors influencing this relationship. Relevant agencies need to pay attention to stricter environmental regulations to control the negative impact of FDI on carbon emissions, while encouraging the development of socially and environmentally responsible Islamic capital markets..

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