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Sustainable development challenges in Indonesia: A macroeconomics approach to finance, energy, and environment

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ABSTRACT

This study aims to examine the relationships among credit dynamics, foreign direct investment, energy, economic growth, and environmental degradation in Indonesia from 1990 to 2024. Using a quantitative path analysis, this study examines the direct and indirect effects of working capital credit, consumer credit, foreign direct investment (FDI), and electricity consumption on environmental degradation via economic growth. The results reveal that all variables have a positive and significant effect on economic growth, with electricity consumption ($\beta = 0.361$; $p < 0.007$) being the primary contributor. Economic growth and electricity consumption also significantly increase environmental degradation, supporting the Environmental Kuznets Curve (EKC) hypothesis in Indonesia. Moreover, the analysis of indirect effects shows that economic growth mediates the relationships among credit distribution, FDI, and environmental degradation. This research is important because it examines sustainable development in Indonesia, where economic growth driven by the financial sector, FDI, and electricity consumption could increase carbon emissions and environmental degradation. These findings are relevant because they provide empirical evidence on the impact of financial and energy activities on environmental quality, both directly and through economic growth, in line with Indonesia's commitment to the SDGs and the green economy transition.

1. Introduction

Environmental pollution is now a concern, especially in the industrial sector, which often prioritizes increased production over its negative environmental impacts. A lack of awareness regarding the negative consequences of environmental neglect will threaten the sustainability of society, both in the present and the future (Alvarado et al., 2018). Carbon emissions have become one of the causes of climate change in the world. This process can affect the environment and human health and create economic instability. Therefore, environmental degradation has become one of the leading global problems due to the massive increase in greenhouse gases, which has an impact on increasing the average global temperature (Abbass et al., 2022).

Human activities on the Earth's surface that lead to environmental damage are the main causes of climate change (Zafar et al., 2021). The increase in the Earth's temperature results in global warming,

causing rapid changes in the Earth's climate (Sivaramanan, 2019). This becomes a consequence of the impact of natural gas, coal, and oil emissions, with a percentage of almost 60% as one of the causes of significant climate change (Ahmed et al., 2019). The accumulation of the impact of human life activities on the earth over the past few decades, especially the industrial revolution, has increased CO_2 levels Tcaused by the continuous burning of fossil fuels (Zandalinas et al., 2021). In addition, CO_2 emissions will affect the productivity of developing countries, such as Indonesia. As is well known, the higher a nation's productivity, the greater its economic growth.

Economic growth is defined as the increase in the availability of goods and services per capita. Numerous resources are required to produce goods and services, including those derived from nature or the biosphere. In addition, many solid, liquid, and gas wastes are created in the production of goods and services. Therefore, sustainable economic growth impacts the increasing use of goods and services. Infrastructure development, including water and sanitation, hospitals, and highway construction, as well as social and economic infrastructure, aims to increase the country's overall productivity. However, the impact of infrastructure development on environmental quality also needs to be considered without ignoring the primary goal of the Sustainable Development Goals (SDGs) (Mutiiria et al., 2020; Nchake & Shuaibu, 2022). Moreover, Djanggo et al (2020) Also stated in their research is that infrastructure contributes to efforts to increase economic growth and community welfare. However, carbon emissions contribute to global warming, hindering sustainable economic development. Thus, it becomes a challenge for business actors and the community to carry out sustainable economic growth while still considering environmental issues, namely, reducing CO_2 emissions (Sadiq et al., 2024).

To foster national development and foster economic growth, the banking sector, which plays a role in providing credit facilities to businesses, is also expanding. Increasing financial development in a country is the first step towards greater environmental awareness (Elatroush, 2025). The relationship between businesses and banks directly impacts environmental sustainability, as businesses generate waste that can damage the surrounding environment. Therefore, more and more companies are becoming aware of the importance of preserving the environment and protecting the Earth. Sustainable environmental management involves providing resources that the current generation needs without sacrificing future generations' needs (Sarma & Roy, 2021). Implementing environmentally friendly credit aims to improve environmental conditions for sustainable development (Chen et al., 2021). One way banking in Indonesia addresses environmental issues is through an initiative known as green banking initiatives. Every credit given to the business sector must take into account various environmental criteria (Naiborhu, 2023). Implementing green banking in the banking sector aims to prevent environmental damage due to economic activities. Financial institutions provide credit and investment loans, subject to the condition that the funds must be used for environmentally friendly purposes and processes. The production process must also be free of environmental pollution, enabling CO2 emissions to be reduced through a green financial policy (Lin et al., 2022).

Besides credit distribution, Foreign Direct Investment (FDI) plays a vital role in the Indonesian economy. FDI is an investment made by foreign companies or individuals into a particular business or sector in Indonesia, usually in share ownership or other productive assets. FDI helps boost economic growth, job creation, and technological and infrastructure development. FDI is also considered an essential part of economic growth and financial globalization, as it is believed to bring much-needed foreign capital, new technology, and knowledge (Osei & Kim, 2020). However, the presence of FDI ignores the potential impacts, namely, CO2 emissions from foreign inflows (Dhrifi et al., 2020). FDI accounts for 6.3% of the environmental degradation in BRICS countries, 2.3% in developing countries, and 3% in developed countries (Muhammad et al., 2021). In addition, Cheng et al (2019) show that foreign investment contributes in environmental degradation and that investment in renewable energy can help reduce it. Therefore, the government requires businesses to continue protecting the surrounding environment through environmental protection policies (Ditta et al., 2023). Furthermore, environmental protection policies require a country to reduce emissions by using renewable energy and promoting environmentally friendly technologies (Alvarado et al., 2018).

A study by Rjoub et al (2021) found that economic growth and energy use are the main drivers of environmental degradation in many countries. Another study by Rahman and Vu (2020) found that economic growth, trade, and energy consumption contribute to CO_2 emissions. In their research,

Liu and He (2021) noted that price-based and quantity-based credit have a clear impact on output, the environment, health, and utility welfare, thereby fostering an environmentally friendly and mutually beneficial industrial structure in China. Previous studies have analyzed the relationship between economic activity and environmental degradation separately, focusing solely on energy consumption as the primary determinant of carbon emissions. However, the simultaneous influence of financial, industrial, and energy variables remains relatively limited, especially in the Indonesian context. Several previous studies have tended to isolate analyses of the financial sector, such as bank credit and FDI, without integrating them into a comprehensive analytical framework. Furthermore, research on the Environmental Kuznets Curve (EKC) hypothesis generally relies on conventional regression approaches that fail to capture indirect relationships or to identify the mediating role of economic growth in depth.

This study attempts to fill this gap by applying path analysis to examine the direct and indirect effects of credit distribution, FDI, and energy consumption on environmental degradation in Indonesia, which has unique structural characteristics as a developing country. The novelty of this study lies in developing an empirical framework that integrates financial and energy indicators into a single model of environmental degradation to explain the trade-off between economic growth and environmental quality in a national context. Specifically, this study aims to analyze the impact of credit distribution, FDI, and electricity consumption on environmental degradation, with economic growth as a mediating variable. The selection of variables is based on the reality of the increasing demand for goods and services in the modern economy, which drives production expansion and development. The national development process is inseparable from bank financing and foreign investment flows, while production activities increasingly dependent on electricity have the potential to increase CO2 emissions. The main contribution of this study is to enrich the literature on the trade-off between economic growth and environmental quality within the framework of sustainable development. By identifying direct and indirect influences, this study can explain the role of economic growth as a mediating variable that is often overlooked in single regression models. In addition, this study provides a comprehensive overview of the long-term dynamics among the financial sector, energy consumption, economic growth, and environmental degradation. These findings are expected to serve as an analytical basis for formulating green financial policies, strengthening sustainable banking practices, promoting environmentally friendly foreign investment, and accelerating the transition to renewable energy, so that economic growth can be achieved without sacrificing environmental sustainability.

2. Literature Review

Advances in the financial sector, whether through credit disbursement or foreign direct investment (FDI), are often a driving force behind economic growth. With broader access to financing, businesses can expand or initiate new productive activities, ultimately boosting income and economic activity (Firmansyah, 2024). However, behind this impetus lies a significant consequence: the risk of increased CO_2 emissions and greater environmental pressure. Therefore, credit disbursement should consider not only profitability but also the long-term impact on sustainability. Financial institutions should be more selective and encourage environmentally friendly business practices, while borrowers should shift to cleaner energy sources to reduce the environmental burden of their production activities (Tahir et al., 2024). Bui (2020) also warns that financial development can exacerbate environmental degradation, with income inequality as one mechanism. Ideally, access to financing should be open to businesses of all sizes. However, as funding becomes more readily available, production capacity tends to increase, often accompanied by greater resource exploitation. Furthermore, easier access to finance drives household consumption, for example, the purchase of vehicles, houses, and various appliances, all of which require more energy. This increased energy consumption leads to higher emissions and worse environmental quality. Findings by Ntarmah et al (2021) corroborate this, showing that credit expansion is positively and significantly correlated with both carbon emissions and economic growth in several East African countries.

The Environmental Kuznets Curve (EKC) concept is often used to explain how economic growth relates to environmental conditions over time. This idea was first introduced by Grossman and Krueger (1991), who described an inverted-U-shaped relationship between per capita income and environmental degradation. In the early stages of development, as industrialization, energy consumption, and urbanization increase, environmental quality typically declines. However, once

people's incomes reach a certain level, concern for sustainability begins to grow. Technological improvements, stricter regulations, and growing environmental awareness gradually led to a decline in pollution levels (Sarkodie & Strezov, 2019). Several empirical studies support this pattern in both developed and developing countries. Shahbaz et al (2019) found that economic growth initially increases CO_2 emissions but, in the long run, contributes to environmental improvements as income levels rise. In Southeast Asia, Adebayo et al (2021) showed that financial sector development, FDI flows, and energy consumption actually worsen environmental conditions in the short term. However, in the long term, these factors can drive a greener transformation through investment in cleaner technologies.

However, recent findings indicate that the EKC pattern does not necessarily apply to every country. Many factors, such as the quality of institutions, the extent of renewable energy adoption, the level of technological innovation, and openness to international trade, can all influence when (or whether) the turning point in the curve is reached (Horobet et al., 2024). In certain situations, rapid industrial growth without strong environmental governance does not lead to a reduction in pollution (Jeetoo & Chinyanga, 2023). Therefore, the EKC is more appropriate as an analytical tool to assess a country's position on its development and environmental trajectory. In Indonesia, this framework helps assess whether economic growth has reached a stage where economic expansion can go hand in hand with environmental protection. This study uses the EKC approach to examine whether economic growth links financial variables, energy consumption, and environmental degradation. In this way, this study attempts to determine the extent to which Indonesia is moving towards a more sustainable development path.

Electricity has become part of our daily routine, and almost all productive activities depend on it. Therefore, efficient electricity use is no longer an option, but a necessity. Energy efficiency means producing the same output with less energy than necessary. Unfortunately, electricity waste still occurs frequently, generally due to a lack of awareness about managing energy consumption wisely. The impact is not only felt in terms of costs, but also on the environment and health, even contributing to climate change in various regions of the world (Imbrenda et al., 2021). Several studies have shown a close link between energy consumption, economic growth, and carbon emissions. Huang et al (2022) Found a positive long-term relationship between energy use and carbon production. This means that as energy consumption increases, carbon emissions tend to increase as well. Onalan & Basegmez (2018) emphasizes that economic development is influenced by various factors such as labor, technological progress, energy, and capital accumulation, all of which are important inputs in the production process and income generation.

Meanwhile Liu (2020) showed that the relationship between economic growth and carbon emissions follows a Kuznets curve pattern, namely an inverted U-shape. In the early stages, economic growth tends to increase emissions, but once income reaches a certain level, environmental pressure begins to decline. Research by Awan et al (2022) in Malaysia for the period 1965–2018 also found that energy consumption and capital formation both contribute to increased pollution. Therefore, careful planning is needed to ensure that economic development is not continuously accompanied by increasing environmental degradation. Several previous studies have examined the link between economic growth and environmental issues, highlighting energy consumption as a key driver of economic expansion while also creating ecological pressures. This study expands on this discussion by including credit distribution, FDI, and electricity consumption as variables that are assumed to influence environmental degradation, both directly and through their effects on economic growth. With this approach, the findings are expected to enrich and complement the existing literature.

3. Method

This is quantitative research. This study uses annual time series data in Indonesia for the period 1990 – 2024 (N = 34). Table 1 shows the dataset was compiled from obtaining information in the form of documents and reports as research support, sourced from the Central Bureau of Statistics, World Bank, Bank Indonesia, and the Energy Information Administration (EIA). All data are transformed into natural logarithms to minimize heteroscedasticity and ensure consistency in scale measurement. Path Analysis was used to examine the pattern of correlations among variables rather than using single-equation regression. This analysis describes the contribution of total impacts from direct influences (e.g., energy use on emissions) and indirect pathways (e.g., credit that drives economic growth and ultimately increases emissions). Figure 1 shows the diagram of path analysis model.

Table 1. Operational Definitions

No	Variables	Operational Definition	Unit	Source
1	Working Capital Credit	Credit facilities are provided to meet specific working capital needs, such as inventory/projects.	Percent (%)	Bank Indonesia
2	Consumption Credit	A credit facility provided to an individual by a financial institution or lender for personal, non-business purposes.	Percent (%)	Bank Indonesia
4	Foreign Direct Investment (FDI)	Investments made by companies or individuals from one country to another to establish a business, gain managerial control, or own productive assets in the destination country.	Percent (%)	World Bank
3	Electrical Energy Consumption	Total energy usage is calculated by multiplying the electronic device's power by the time it is used.	kWh per capita	Energy Information Administration (EIA)
5	Economic Growth	An increase in the ability of an economy to produce goods and services.	IDR	Central Bureau of Statistics
6	Environmental Degradation	The depletion of resources such as air, water, and soil, the destruction of ecosystems and habitats, the extinction of wildlife, and pollution damage the environment.	CO_2 emission (metric tons) per capita	World Bank, Global Carbon Project

Source: multiple sources

This framework is relevant in the Indonesian context, given the close interconnections between the financial, industrial, and energy sectors. Through path analysis, this study identifies simultaneous and mediating influences often overlooked by conventional models, providing a deeper understanding of the mechanisms linking economic activity and environmental quality. A variable-relationship structure is formulated to analyze the relationships among credit, foreign direct investment, energy consumption, economic growth, and environmental degradation.

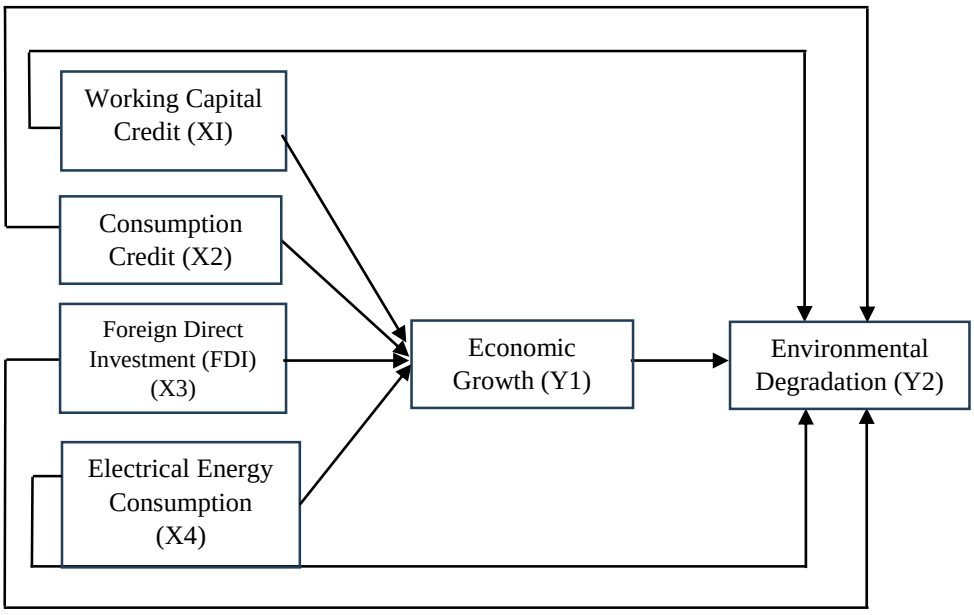

Figure 1. Path Analysis Model

This empirical model is based on the Environmental Kuznets Curve (EKC) framework and expands it by integrating finance and energy as determinants of environmental performance. Theoretically, it is assumed that finance, FDI inflows, and energy consumption directly influence economic growth, while growth and energy use contribute to increased CO_2 emissions, an indicator of environmental degradation. The model equation specifications in this study are as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \quad (1)$$

Where Y is the dependent variables; $X_1 - X_5$ is the independent variables; α is the constanta; $\beta_1 - \beta_5$ is the coefficient of independent variables; ε is the error term. Figure 1 shows the detail of variables and models used in the study in form of path analysis and the path diagram shows that credit, FDI, and energy consumption are expected to have a positive direct effect on economic growth and environmental degradation.

4. Results and Discussion

4.1. Direct Effect on Path Analysis Test I and Test II

The findings of the first-stage path analysis indicate that all tested variables (working capital credit, consumer credit, foreign direct investment (FDI), and electricity consumption) have a positive and significant effect on economic growth in Indonesia as shown in Table 2. Working capital credit has a coefficient of 0.294 (p = 0.025), indicating that increased productive financing encourages business expansion and increases in national output. Consumer credit also shows a significant effect (β = 0.342; p = 0.016), reflecting that increased purchasing power strengthens aggregate demand and stimulates economic growth.

Table 2. Result of Path Analysis Test I

Variables	Coefficient
X_1	0.294 (1.362)**
X_2	0.342 (1.583)**
X_3	0.361 (1.413)***
X_4	0.248 (1.205)**
R-Squared	0.392

Source: data processed

Table 2 shows the FDI shows a significant positive effect on economic growth (β = 0.361; p = 0.007), indicating the important role of foreign investment in increasing productivity and encouraging technology transfer. Meanwhile, electricity consumption also has a positive and significant effect (β = 0.248; p = 0.031), indicating that increased energy use is in line with the expansion of industrial activity and economic activity in general. Overall, these results underscore that financial and energy factors are important elements in supporting Indonesia's economic growth.

Table 3. Result of Path Analysis Test II

Variables	Coefficient
X_1	0.113 (2.518)**
X_2	0.175 (1.853)**
X_3	0.138 (1.245)**
X_4	0.237 (0.661)***
Y_1	0.581 (2.372)**
R-Squared	0.392

Source: data processed

Table 3 shows the results of the second-stage path analysis show that working capital credit, consumer credit, foreign direct investment (FDI), electricity consumption, and economic growth have a positive and significant effect on environmental degradation in Indonesia. Working capital credit has a coefficient of 0.113 (p = 0.039), indicating that increased financing for productive activities increases environmental pressure alongside economic expansion. Consumer credit also shows a significant positive relationship (β = 0.175; p = 0.028), indicating that increased public consumption drives greater production and use of natural resources. FDI has a positive and significant effect on environmental degradation (β = 0.138; p = 0.015), suggesting that foreign investment primarily flows into energy-intensive sectors. On the other hand, electricity consumption shows a relatively large coefficient after economic growth (β = 0.237; p = 0.009), confirming that dependence on fossil fuels is a major determinant of increased carbon emissions. Meanwhile, economic growth has the strongest influence on environmental degradation (β = 0.581; p = 0.033), confirming that Indonesia's current economic expansion remains out in step with environmental sustainability principles.

4.2. Correlation Model of Working Capital Credit, Consumption Credit, FDI, Electricity Consumption, Economic Growth, and Environmental Degradation

Figure 2 shows that the working capital credit variable has a coefficient of 0.294 on economic growth. The influence of the consumption credit variable on economic growth shows a coefficient value of 0.342, the FDI variable on economic growth with a coefficient value of 0.248, the electricity consumption variable on economy with a coefficient value of 0.361, the working capital credit variable on environmental degradation with a coefficient value of 0.113.

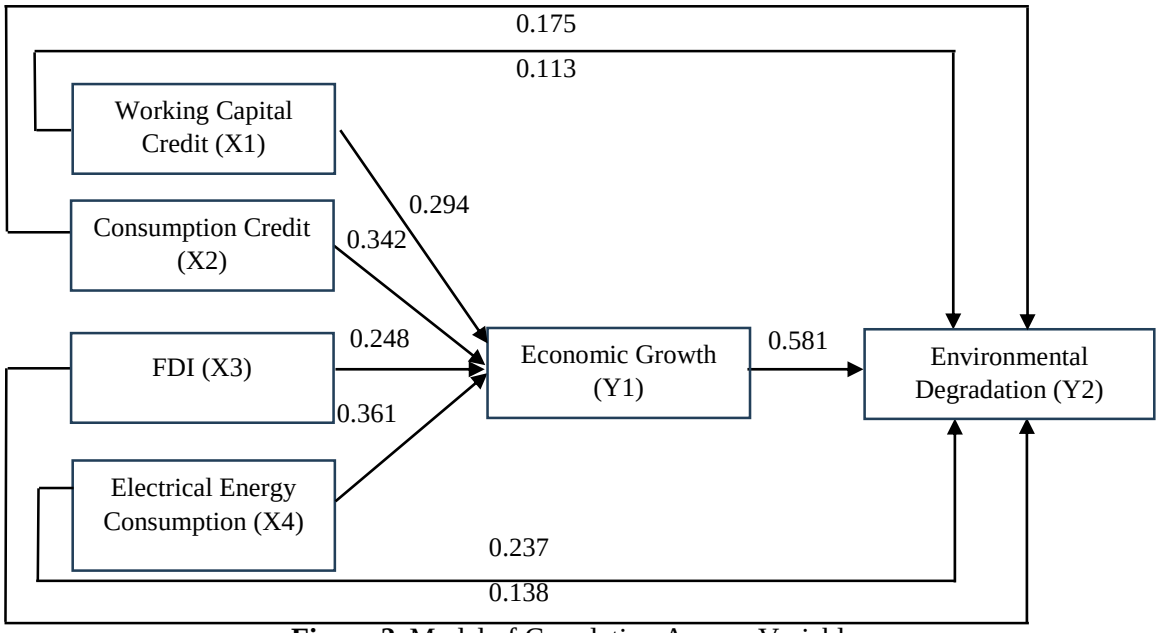

Figure 2. Model of Correlation Among Variables

The consumption credit variable on environmental degradation with a coefficient value of 0.175, the FDI variable on environmental degradation with a coefficient value of 0.138, the electricity consumption variable on environmental degradation with a coefficient value of 0.237, and economic growth on environmental degradation with a coefficient value of 0.581.

4.3. Indirect Effect

Indirect influence was obtained from the correlation between the X and Y variables via intervening variables, so calculations are needed to determine its magnitude. To find out how much influence working capital credit has on environmental degradation through economic growth, the calculation below is obtained:

$$IE = 0.294\ x\ 0.581 = 0.170$$

The calculation indicates that the indirect influence of working capital credit on environmental degradation through economic growth resulted in 0.170. The result shows that the indirect influence is greater than the direct influence (0.170 > 0.113). It can be concluded that economic growth mediates the correlation between working capital credit and environmental degradation. This shows that the

expansion of productive financing drives economic growth, which ultimately increases environmental pressure. The effect of consumer credit on environmental degradation through economic growth as follows:

$$IE = 0.342\ x\ 0.581 = 0.198$$

The result shows that the indirect influence of consumer credit on environmental degradation through economic growth is 0.198. The result indicates that the indirect impact is greater than the direct impact (0.198 > 0.175). It can be concluded that economic growth mediates the correlation between consumer credit and environmental degradation. Increased public consumption stimulates economic growth, which in turn contributes to higher emissions and the exploitation of natural resources. The effect of FDI on environmental degradation through economic growth as follows:

$$IE = 0.248\ x\ 0.581 = 0.144$$

Means the indirect influence of FDI on environmental degradation through economic growth is 0.144. This indicates that the indirect effect is greater than the direct effect (0.144 > 0.138), so economic growth mediates the correlation between FDI and environmental degradation. These results indicate that increased FDI drives economic growth, which in turn contributes to increased environmental degradation. The measurement of effect of electrical energy consumption on environmental degradation through economic growth as follows:

$$IE = 0.361\ x\ 0.581 = 0.209$$

The results show that the indirect effect of electricity consumption on environmental degradation through economic growth is 0.209. This value is smaller than the direct effect of 0.237, so the direct effect appears more dominant. This finding suggests that economic growth, as an intermediary variable, does not mediate the relationship between electricity consumption and environmental degradation. In other words, increased energy use tends to directly cause environmental damage, without first going through the mechanism of economic growth.

4.4. Discussion

Table 2 shows that working capital loans and consumer loans have a positive and significant impact on economic growth in Indonesia, with p-values of 0.025 and 0.016, respectively. A positive coefficient indicates that increased credit distribution is correlated with accelerated economic growth in Indonesia. This finding is consistent with the research of Ananzeh (2016) which emphasized the importance of bank credit facilities, particularly in the primary economic sector, in driving economic growth. The study explained that bank credit serves as a primary source of financing for various economic activities and channels it more effectively to productive sectors. Based on their intended use, bank loans are grouped into several types to support business and consumer needs. This financing program makes it easier for companies and MSMEs to expand their businesses and increase production capacity, ultimately driving economic growth. Another study by Ozili et al (2023) shows that credit expansion significantly affects economic growth. Access to credit enables households and businesses to increase purchases of goods and services, thereby strengthening market demand. This increased demand encourages companies to increase production. In this context, bank credit acts as a catalyst that drives economic activity and contributes to job creation (Hacievliyagil & Eksi, 2019).

Another result from Table 2 shows FDI has a positive and significant effect on economic growth in Indonesia (p-value = 0.007). A positive coefficient indicates that higher foreign investment flows are associated with higher economic growth. This finding aligns with research by Bakpa and Yeboah (2024), who found that FDI positively contributed to economic growth in Ghana. Similar results were also reported by Chaudhury et al (2020) who showed that FDI significantly influenced economic growth in South Asia. In general, foreign investment is seen as a crucial element in economic development, especially in developing countries seeking to increase their production capacity. In addition to driving economic expansion, FDI can create jobs by building new projects or expanding existing production facilities in the recipient country. The presence of multinational companies also contributes to improving the quality of local resources through the transfer of knowledge, training, and work experience, thereby strengthening the capacity of the domestic workforce (Temiz & Gokmen, 2014). electricity consumption has a positive and significant effect on economic growth in Indonesia (p = 0.031). The positive coefficient indicates that increased electricity use is in line with increased economic growth. This result aligns with the findings of Shahbaz et al (2019), who showed

that renewable energy, non-renewable energy, capital, and labor contribute positively to economic growth, particularly through renewable energy consumption. Gozgor et al (2018) also found that economic complexity and the consumption of non-renewable and renewable energy correlate with higher economic growth rates. Economically, high electricity consumption reflects increased production activity and public demand, thus contributing to GDP growth. However, energy-efficiency efforts remain necessary without hindering economic expansion. Reducing dependence on fossil-based energy must be pursued gradually and consistently within a sustainable development framework. Economic growth remains crucial for improving welfare, but policies to control energy consumption, for example, through tax instruments or disincentives for excessive energy use, can be an alternative to maintain a balance between economic expansion and environmental sustainability (Topolewski, 2021).

Table 3 shows that credit distribution, both working capital and consumer credit, has a positive and significant impact on environmental degradation in Indonesia ($p < 0.05$). This means that high bank financing is correlated with worsening environmental quality. This finding is consistent with Shahbaz et al (2013), who demonstrated that conventional bank credit significantly impacts environmental conditions in Indonesia. Saud et al (2020) explain that a developed financial system expands access to capital, improves living standards, and accelerates economic development. However, this ease of financing also leads to increased energy consumption and greenhouse gas emissions. Thus, while the availability of funds can stimulate growth, it also has the potential to depress environmental quality (Saud et al., 2018). Beyond these negative impacts, the literature also demonstrates another side of financial development. An efficient financial system and adequate capital support can accelerate the adoption of more modern, energy-efficient, and environmentally friendly production technologies, thereby helping to mitigate environmental degradation (Fan et al., 2025). Therefore, although credit plays a significant role in driving demand and economic growth, it is necessary to anticipate this through more sustainability-oriented policies, such as green production practices, more responsible consumption patterns, and effective waste management.

Table 3 shows that FDI has a positive and significant effect on environmental degradation in Indonesia (p-value = 0.015). This study's results align with Sabir et al (2020), who found that FDI has a positive, statistically significant influence on environmental degradation. The government cannot ignore the role of foreign direct investment (FDI) in economic growth in developing countries. Most of these countries take. Various policy measures, such as trade liberalization and financial sector deregulation, were implemented to attract greater FDI inflows and support economic development. FDI provides economic benefits through capital formation and the transfer of technology and knowledge, thereby increasing productivity. The export and import of technology causes air pollution. FDI also encourages economic growth through methods (Sabir and Gorus, 2019). Foreign companies tend to invest in other countries to access natural resources unavailable in their home countries. Depletion of natural resources, among other impacts of foreign direct investment, will cause more severe environmental damage (Solarin & Al-Mulali, 2018). Therefore, it is crucial to examine the level of institutional quality, particularly the impact of FDI on the environment, especially in developing countries. The South Asian region is the largest recipient of FDI, resulting in CO2 and other greenhouse gas emissions, as well as deforestation (Sabir et al., 2020).

Another result from Table 3 that electricity consumption positively and significantly influences environmental degradation in Indonesia (p-value = 0.009). Research by Rahman (2020) suggests a long-term correlation between electricity consumption and economic growth, which positively and significantly influences CO_2 emissions in China, the USA, India, Japan, Germany, Canada, Brazil, South Korea, France, and the UK. In general, these countries need to ensure that their economic policies align with their energy policy direction. Controlling energy or electricity consumption should be done in a measured manner to avoid suppressing economic growth. The findings of this study indicate that the use of electricity from non-renewable sources contributes to increased CO_2 emissions in the Mediterranean region, both in the South and North. Mahmood et al (2019) also emphasized that energy consumption is a major contributor in environmental degradation through increased carbon emissions. These results reinforce the urgency of developing renewable energy as an effort to maintain energy security while reducing emissions and protecting the environment for future generations. Harnessing the potential of renewable energy can help many countries reduce their dependence on high-carbon energy sources. One strategic step is to build an integrated electricity grid across regions to promote cleaner, more efficient energy distribution (Belaïd & Zrelli, 2019). Energy use, particularly from fossil fuels, contributes to air pollution and environmental damage. Therefore, transitioning to

clean energy technologies and reducing dependence on fossil fuels are crucial steps to support sustainability. The government also needs to strengthen energy sector policies through intensification, diversification, and conservation strategies to minimize the resulting ecological impacts.

Table 3 shows that economic growth has a positive and significant effect on environmental degradation in Indonesia ($p = 0.033$). This means that increased economic activity tends to be followed by worsening environmental quality. This finding aligns with Kyun Kim (2020), who used the PVAR-GMM approach, found that GDP and energy consumption are positively and significantly related to environmental indicators such as the ecological footprint (EF), CO_2 emissions, and the Environmental Performance Index (EPI). Industrial development and increased production, particularly in developed countries, contribute to increasing carbon emissions. The intensity of energy use in industrial processes also increases environmental pressure. In the context of the EPI, the study found a link between economic growth and energy consumption. Several countries are shifting from conventional energy to renewable energy as per capita income increases. Other research also confirms that economic development and environmental degradation move in tandem, so economic growth is often the primary factor in increasing ecological pressure (Mohsin et al., 2019). While economic activity can boost well-being, it also incurs high environmental costs. Therefore, implementing green innovation in sustainable business practices is crucial to maintaining a balance between economic expansion and environmental sustainability. Communities have the right to a healthy environment with clean air and clean water, which can only be achieved through business commitment to responsible practices and strong government policies that maintain ecological balance.

5. Conclusion

This study aims to examine the relationship between credit dynamics, foreign direct investment, energy, economic growth, and environmental degradation in Indonesia. This research is important because Indonesia continues to face challenges in accelerating economic growth while maintaining environmental sustainability amid rapid economic activity, rising foreign investment, and increasing electricity consumption. As a developing country committed to the Sustainable Development Goals (SDGs), understanding how financial and energy-driven growth contribute to environmental degradation is crucial in designing a balanced development strategy. By focusing on the role of bank credit, foreign direct investment (FDI), and energy consumption, this study provides a comprehensive perspective on the structural challenges of sustainable development in Indonesia. Methodologically, this study uses path analysis on annual time-series data from 1990 to 2024 to capture the direct and indirect relationships among financial variables, energy consumption, economic growth, and environmental degradation. Unlike conventional regression approaches, path analysis can identify mediating effects, particularly the role of economic growth in transmitting the distributional impacts of credit and FDI to environmental outcomes. This approach enhances analytical depth and offers a clearer understanding of the mechanisms linking finance, growth, and environmental quality within the Environmental Kuznets Curve (EKC) framework.

The findings show that working capital credit, consumer credit, FDI, and electricity consumption significantly increase economic growth but also exacerbate environmental degradation through increased CO_2 emissions. It is known that economic growth mediates the effect of financial variables on environmental degradation, while electricity consumption has a strong direct impact, reflecting Indonesia's continued dependence on fossil fuels. These results imply that economic expansion alone is insufficient to achieve sustainability unless accompanied by green financial policies, stricter environmental investment screening, and accelerated adoption of renewable energy. Therefore, this study provides important policy insights to promote environmentally responsible finance and investment and ensure sustainable long-term economic growth.

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Declarations

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