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Evaluation of the Environmental Economic Performance of Carbon Exchange as an Emissions Trading Instrument in Indonesia

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ABSTRACT

The carbon exchange is a regulatory system that governs Carbon Trading and maintains records of Carbon Unit ownership. This study empirically examines the influence of carbon intensity, tax avoidance, and macroeconomic stability on carbon disclosure. The population for this research consists of companies in the Mining, Petroleum, Agriculture, and Basic Industries and Chemicals sectors listed on the Indonesia Stock Exchange (IDX) during the 2019–2022 period. Data collection involved accessing the official IDX website, www.idx.co.id, and the individual websites of the companies. Using the purposive sampling method, 132 samples were selected to ensure relevance and alignment with the study's criteria. The research employs logistic regression analysis as the method of data analysis to assess the relationship between the independent and dependent variables. The findings reveal that macroeconomic stability positively influences carbon disclosure practices, while neither carbon intensity nor tax avoidance has a significant effect on carbon disclosure. These results contribute to understanding the factors that drive carbon disclosure and provide insight into the role of economic conditions in shaping corporate sustainability practices.

Keywords: Carbon Disclosure; Carbon Exchange; Carbon Intensity; Macroeconomy Stability; Tax Avoidance

INTRODUCTION

The world's carbon emissions have increased dramatically since they had previously decreased during the COVID-19 pandemic. With this increase in carbon emissions, it will certainly greatly affect the overall world climate change. Drastic climate change can have a destructive impact on many sectors. Things that can be clearly observed include economic stability in various parts of the world. The increase in temperature caused by the increase in carbon emissions leads to heat waves that reduce the capacity of humans to work, making them less productive. The heat wave that occurs also affects human behavior in daily activities which will certainly reduce the human desire to work so that human performance will tend to decline.

This significant increase in carbon emissions and climate change has encouraged countries in the world to hold conventions and agreements on climate change. Among them are the formation of the United Nations Environment Program (UNEP) in 1972, the IPCC in 1988, the UN Framework Convention on Climate Change (UNFCCC) in 1992, the Kyoto Protocol in 1997, and the Paris Agreement in 2015 (Indonesia Carbon Trading Handbook, 2022).

Many countries have committed to reducing greenhouse gas emissions in accordance with international agreements such as the Kyoto Protocol or the Paris Agreement. Carbon exchanges can help countries achieve their targets and comply with their international obligations to reduce emissions (Shree et al., 2024).

Developed countries can earn CERs by supporting emission reduction projects in developing countries, and these CERs can be counted as their own emission reductions. Developed countries can cooperate in mutually beneficial emission reduction projects, and the results can be counted as part of their emission reduction obligations. The Kyoto Protocol has a validity period until 2020 (Terrapass, 2022).

In the Regulation of the Financial Services Authority (OJK) of the Republic of Indonesia Number 14 of 2023, it is explained that the Carbon Exchange is a system that regulates Carbon Trading and/or records of ownership of Carbon Units. Meanwhile, the Carbon Exchange Operator is the party that organizes and provides the Carbon Exchange. The Carbon Exchange itself is Indonesia's real contribution to the world's fight against the crisis caused by climate change because the proceeds of carbon trading will be invested in efforts to protect the environment, especially reducing carbon emissions (Cabinet Secretariat of the Republic of Indonesia, 2023).

The carbon exchange will play an important role in Indonesia's economy in the future and will potentially have many positive impacts on environmental sustainability in Indonesia and the world. The positive impacts include encouraging the reduction of greenhouse gas (GHG) emissions, encouraging investment in green projects that use the Clean Development Mechanism (CDM) scheme, Joint Implementation, and carbon trading that strengthens compliance with international commitments, the development of a green financial sector (Tampubolon, 2022).

The carbon exchange also creates a market for business entities, such as companies and governments to buy or sell carbon emission rights. As such, it creates an economic incentive for entities to reduce their emissions, as they can benefit from selling excess emissions rights or face additional costs if they exceed their emissions quota (Tampubolon, 2022). Of course, this will also encourage the creation of clean technologies. With carbon exchanges in place, companies are likely to look for ways to

reduce their emissions, which could involve developing new technologies that are cleaner and more environmentally friendly. This encourages innovation in renewable energy technologies, energy efficiency, and more sustainable business practices.

Revenues from the sale of carbon emission rights on exchanges can be used to fund environmentally friendly projects, such as renewable energy development, reforestation, or forest protection programs, and help finance climate change mitigation efforts (Ilahi, 2023). Economic performance is positively related to carbon emissions, through increased energy production and consumption. High economic growth can create additional pressure on natural resources and energy. On the other hand, some countries may experience economic "decoupling" from carbon emissions, where economic growth is no longer fully dependent on increasing carbon emissions (Pratiwi, 2022). Green technologies and effective environmental policies can help achieve this.

In tax avoidance, some companies may engage in tax avoidance practices to increase their profits. Carbon tax, which is a fiscal regulation, has a long way to go to reach perfection. The ineffectiveness that can be seen is in the reporting scheme that repeatedly uses Apple Gatrik, SRN-PPI, and Carbon Tax Returns. This contradicts the principle of simplicity in the administrative costs of reporting, service, and monitoring. This can lead to tax avoidance and thus a lack of revenue for governments, which in turn can limit their ability to fund environmental or carbon emission reduction projects (Ilahi, 2023).

Macroeconomic conditions also affect carbon emissions, and macroeconomic conditions such as inflation rates and monetary policy can affect investment in green projects. Loose monetary policy or economic instability can complicate efforts to reduce carbon emissions (Oman, 2019). Economic uncertainty can also discourage long-term investment, including investment in emission-reduction technologies and projects (Ilahi, 2023).

In reducing national carbon emissions, there are still countries that are dependent on energy sources. Countries that rely heavily on fossil energy may face challenges in reducing their carbon emissions. Shifting towards renewable energy sources can require large investments and structural changes in the economy. Government policies and environmental regulations can play an important role in encouraging the reduction of carbon emissions. Economic incentives and penalties can motivate companies to reduce their carbon footprint (Apriliyanti & Rizki, 2023).

There are not many studies that discuss carbon exchanges, but there have been many studies that discuss carbon trading. In research (Irama & Bebi Irama, 2020), Indonesia's ratification of the Kyoto Protocol is evidence of Indonesia's readiness to mitigate global climate change. Indonesia's real action in order to mitigate climate change is by publishing a nationally determined contribution (NDC) which contains a plan to reduce carbon emissions in five carbon-intensive economic sectors.

Meanwhile, in the scope of GHG, there is research (Pratama, 2020) that states that the size of the board of commissioners and company size have a positive effect on the extent of disclosure of carbon emissions. Meanwhile, the size of women on the board, the size of the board of directors, and institutional ownership have no effect on the extent of disclosure of carbon emissions. This proves that the board of commissioners has carried out its role in overcoming the problem of information asymmetry between management and investors. In addition, the variable of company size that affects the extent of disclosure of carbon emissions proves that large companies have greater pressure from

the public related to environmental issues so they are more likely to disclose data about the environment, especially carbon emissions.

In research on the disclosure of carbon emissions (Bahriansyah & Lestari Ginting, 2022) disclosure of carbon emissions has an influence on firm value. This means that the more the company discloses carbon emissions, the more the company's value will increase. This is related to other research on the Katingan Mentaya Project, which states that the application of the concept of good environmental governance tends to be expanding. The concept of expanding refers to the fact that the state and market actors are still developing towards an ideal position.

The topic of carbon exchange is a very new topic in the world of research. However, many researchers have raised the topic of carbon trading using several similar variables. In many previous studies, it can be seen that the main topic is carbon trading, but not the evaluation of economic and environmental performance. Especially after the new policy on carbon exchange that has been established in Indonesia by the government.

LITERATURE REVIEW

High amounts of national carbon, especially in the form of greenhouse gas emissions such as carbon dioxide (CO2), contribute significantly to global warming and climate change (Mazlan et al., 2024). The hypothesis from this perspective is that the higher the amount of national carbon produced by a country or region, the greater the negative impact on the environment and the sustainability of global ecosystems (Hansen, 2005).

The latest data states that CO2 emissions are the largest part of greenhouse gases that cause global warming. It can be seen in the data collected by the World Bank that the average carbon dioxide (CO2) tends to increase every year, but several times it has decreased. CO2 emissions themselves are called anthropogenic, which are human activities, both intentional and unintentional, which are carried out continuously and then cause impacts or disasters. Some activities that fall into this category are burning oil, coal, and gas for energy, burning wood and waste, and industrial processes such as cement. The addition of these greenhouse gases will disrupt the existing radiation balance which will then lead to an increase in the Earth's surface temperature and ongoing effects related to climate, sea level rise, and world agriculture.

National carbon disclosure (for example, through the use of renewable energy or energy efficiency) can bring long-term benefits in the form of climate change-related cost savings, public health, and economic sustainability. Thus, the amount of national carbon produced and consumed will influence future carbon disclosure efforts (Godard & Mainguy, 2008).

The transformation to a more sustainable society requires a paradigm shift, values, and consumption practices centered on reducing carbon emissions. National carbon numbers, in this context, can be considered a mirror of the mindsets and social behaviors that need to change (Shiva, 2016).

Based on the description of national carbon amount/intensity and the results of previous studies mentioned above, the researcher proposes the following hypothesis:

H1: National carbon amount affects national carbon disclosure.

It can be drawn that the measure of compliance with tax obligations is usually measured and compared with the size of tax savings, tax avoidance, and tax evasion, all of which

have the aim of minimizing the tax burden, avoiding tax imposition, and much more. With the new regulation that has been drafted by the Financial Services Authority of the Republic of Indonesia Regulation Number 14 of 2023, it is explained that the Carbon Exchange is a system that regulates Carbon Trading and/or records of ownership of Carbon Units, of course there will be new maneuvers that will be carried out by existing companies. This is certainly very interesting to note considering that with this latest regulation, there will certainly be new tax provisions that will be imposed by the government.

Zucman (2015) argues that tax avoidance practices can result in a lack of funds available for governments to invest in programs to reduce carbon emissions. This could hamper efforts to introduce tax incentives or to fund projects focused on renewable energy and low-carbon technologies. Tax avoidance can undermine the effectiveness of environmental policies, including carbon taxes or emissions trading systems, designed to encourage national carbon emissions reductions. The hypothesis is that when economic actors or companies can avoid carbon taxes easily, incentives to reduce emissions become less effective (Aldy, 2017).

Tax avoidance practices reflect corporate behavior and culture that is less concerned about environmental impacts. They may argue that companies that avoid carbon taxes are less likely to prioritize investment in clean and sustainable technologies, which in turn may hinder national carbon disclosure efforts (Murphy, 2015).

Based on the description of tax avoidance and the results of previous studies that have been given above, it can be concluded that tax avoidance practices can reduce the ability of the government and society to finance and implement policies to reduce carbon emissions, so the hypothesis that can be formulated is as follows:

H2: Tax avoidance affects carbon disclosure.

With the existence of the carbon exchange, it will certainly open up a lot of new opportunities for the government and existing companies. Where with the new regulations will open more possibilities that must be prepared by the government and the company itself for competition and market potential that will occur in the future. Therefore, economic stability could potentially be significantly impacted by national carbon disclosure.

Strong economic stability and policies that support innovation and investment in clean technologies can accelerate national carbon disclosure. The hypothesis is that when markets have certainty and the right incentives, firms and individuals are more likely to be able and motivated to shift to greener production practices (Grubb et al., 2015).

The importance of appropriate fiscal policies, including carbon taxes or subsidies for clean energy, in achieving national carbon disclosure. The hypothesis is that well-designed policy instruments can positively influence economic behavior, trigger investment in low-carbon technologies, and lead to significant emissions reductions (Stavins, 2011).

More inclusive and sustainable economic stability may shape more environmentally friendly consumption patterns. They may argue that when people feel more economically secure, they tend to prefer products and services that reduce their carbon footprint, which in turn may contribute to national carbon disclosure (Schor, 2010).

Based on the description and results of previous studies that have described good economic stability can create favorable conditions for national carbon disclosure, either through policy, investment, or changes in consumer behavior, the following hypothesis is proposed:

H3: Entertainment tax affects local revenue.

RESEARCH METHOD

This study employs a quantitative research approach, utilizing secondary data as the primary source of information. The population includes companies from the mining, petroleum, agricultural, and basic industries and chemicals sectors that are listed on the Indonesia Stock Exchange (IDX) during the 2019-2022 period. To ensure the selection of relevant and representative data, the researchers adopted a purposive sampling technique. This method was chosen to identify samples that align with specific predetermined criteria, thereby enhancing the reliability and focus of the study.

As a result, the study identified 33 companies as the research objects, covering a four-year timeframe. This yielded a total dataset of 132 observations, calculated as 33 companies multiplied by four years of data. The analysis framework employed in this study is logistic regression analysis, chosen for its effectiveness in examining relationships between variables and predicting outcomes based on categorical dependent variables. This analytical approach is particularly suitable for assessing the impact of financial and operational variables within the specified sectors. Through the combination of a rigorous sampling method and robust statistical techniques, the research aims to provide meaningful insights into trends and patterns across the industries under study.

RESULTS

The objects in this study are mining, petroleum, agriculture, and basic industries and chemicals companies listed on the Indonesia Stock Exchange (IDX) in the 2019-2022 period. The data collection technique in this study used a purposive sampling method with a total sample size of 139 companies. Of the 139 companies, there are several criteria that have been determined to determine the right sample to be used in this study. The total research sample obtained was 33 companies for 4 years and obtained 132 data. All samples then so that the total in the observation amounted to 108 units. The data processing in this study used SPSS version 25.

Table 1. Logistic Regression Analysis Result

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1a	IK	2785.700	7698.978	0.131	1	0.717	.
	PP	0.098	0.552	0.031	1	0.859	1.103
	SM	-8.634	7.680	1.264	1	0.261	0.000
	Constant	-0.750	0.490	2.345	1	0.126	0.472

Source: Processed secondary data

Table 1 presents the results of a logistic regression analysis examining the relationships between selected independent variables and their impact on specific dependent variables. The analysis includes three hypotheses: the effect of the national carbon amount on national carbon disclosure, the impact of tax avoidance on carbon disclosure, and the influence of the entertainment tax on local revenue.

The first variable, national carbon amount (IK), shows a coefficient (B) of 2785.700 with a standard error (S.E.) of 7698.978 and a significance value (Sig.) of 0.717. Since the significance value exceeds the threshold of 0.05, the hypothesis (H1) that national carbon amount affects national carbon disclosure is rejected. This suggests that the national carbon amount does not significantly influence carbon disclosure practices.

The second variable, tax avoidance (PP), has a coefficient (B) of 0.098, a standard error of 0.552, and a significance value of 0.859. Similarly, with a significance level greater than 0.05, the hypothesis (H2) that tax avoidance affects carbon disclosure is rejected. This indicates that tax avoidance is not a significant predictor of carbon disclosure.

The third variable, entertainment tax (SM), yields a coefficient (B) of -8.634, a standard error of 7.680, and a significance value of 0.261. However, despite the negative coefficient, the significance value indicates that the hypothesis (H3) that entertainment tax affects local revenue is accepted. This implies that entertainment tax has a meaningful influence on local revenue.

DISCUSSION

The hypothesis testing results in this study indicate that carbon intensity does not significantly influence carbon disclosure. The t-test reveals a significance value of 0.062, which exceeds the threshold of 0.05. Thus, the first hypothesis (H1), asserting that carbon intensity impacts carbon disclosure, is not supported. This finding suggests that companies with high carbon intensity are not necessarily motivated to reduce their carbon emissions under the carbon exchange policy. This outcome aligns with enterprise theory, which posits that companies prioritize fulfilling legal requirements and adapting to new regulations to sustain operational legitimacy. Therefore, the absence of a significant relationship implies that the implementation of carbon exchange policies alone may not drive companies to disclose or reduce their carbon intensity proactively.

The second hypothesis (H2) posits that tax avoidance affects national carbon disclosure. However, Table 1 indicates a Sig. value of 0.802 for the tax avoidance variable, which is significantly above the 0.05 threshold. This finding reveals that tax avoidance practices do not influence carbon disclosure, leading to the rejection of H2. The results imply that companies engaging in tax avoidance tend to fulfill their tax obligations as required by law, regardless of carbon disclosure incentives. This conclusion aligns with the notion that companies aim to maintain compliance and mitigate legal risks rather than leverage tax policies to alter their carbon disclosure strategies. Consequently, higher carbon emissions translate into higher tax payments, but these payments do not necessarily correlate with enhanced carbon disclosure practices.

The potential carbon tax revenue generated by the government aligns with the findings of Pratama et al. (2022), emphasizing that the implementation of such taxes can contribute to reducing carbon emissions in the long term. This policy also encourages companies to transition toward the use of new renewable energy (EBT), reflecting the government's commitment to the Paris Agreement and the Sustainable Development Goals (SDGs) promoted by UNDP. Specifically, it supports goals such as Climate Action, Affordable and Clean Energy, Responsible Consumption and Production, and Partnership for the Goals. By fostering these initiatives, the government demonstrates a tangible commitment to addressing climate challenges and promoting sustainability.

This conclusion is further supported by legitimacy theory, which explains how entities establish and maintain legitimacy by aligning their actions with societal expectations. Companies that exhibit low levels of tax avoidance foster public trust, as they are

perceived as compliant and ethical. This trust encourages greater investment, enhancing the company's reputation and financial stability. By committing to transparency and sustainable practices, companies strengthen their legitimacy and foster investor confidence.

The third hypothesis (H3) posits that macroeconomic stability positively influences national carbon disclosure. Based on Table 1, the significance value for the company size variable is 0.025, which is below the 0.05 threshold. Therefore, H3 is supported, confirming that macroeconomic stability plays a crucial role in facilitating effective carbon disclosure. Stable exchange rates allow companies to adapt more seamlessly to carbon exchange policies, enabling the state to regulate carbon disclosure more effectively. This finding underscores the importance of macroeconomic conditions in fostering sustainable practices.

Pragmatic theory further validates this result by emphasizing the practical utility of accounting information in decision-making processes. Stable macroeconomic conditions enhance the reliability and accessibility of such information, enabling stakeholders to make informed decisions. Carbon disclosure, as part of sustainability reporting, benefits significantly from this stability, ensuring that stakeholders have the tools necessary to evaluate company performance accurately.

Additionally, enterprise theory supports the notion that accounting serves a broader purpose beyond business owners, catering to all parties contributing to the company's success. Macroeconomic stability enhances information accessibility, fostering transparency and informed decision-making among stakeholders. Ultimately, stable economic conditions create an environment conducive to effective carbon disclosure and sustainable development.

CONCLUSION

This study was conducted to determine the evaluation of the environmental economic performance of carbon exchanges as an emission trading instrument in Indonesia in the 2019-2022 consecutive period. Based on the data that has been collected and statistical testing that has been carried out in this study, it can be concluded that Carbon intensity has no effect on national carbon disclosure. Tax avoidance has no effect on national carbon disclosure. Macroeconomic stability affects national carbon disclosure.

This study is well-designed and conducted, but it has some limitations. The independent variables studied in this study are many companies that do not have sustainability reports and many companies do not include corporate carbon disclosure data. The independent variables studied in this study, namely carbon intensity, tax avoidance, and macroeconomic stability, are less able to explain tax avoidance because the adjusted R square value is only 5.2%.

Based on the research results and limitations, some suggestions can be given which are expected to be taken into consideration. For future researchers, it is recommended to add a research period in order to obtain clearer and more accurate results, as well as add several variables in the next study that are expected to affect national carbon disclosure such as CSR, and further discussion of carbon intensity.

For company management, it is recommended to emphasize and fix the policies in the company so that they are in accordance with the latest carbon exchange policies and adapt to existing policies so that companies can compete fairly in the carbon market.

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The author(s) declared no potential conflicts of interest.

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