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Does Financial Development Affect the Quality of Environment? Evidence From Indonesia

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Abstract

This study aims to see the effect of financial development on carbon emissions. Using PCA to convert variables into small uncorrelated variables while maintaining the original data, this study uses five variables representing the financial sector converted into two components. The first component consists of variables Domestic credit to the private sector by banks and Domestic credit to the private sector. At the same time, the second component includes variables Domestic credit provided by the financial sector, Market capitalization of listed domestic companies, and Stock Traded. We can conclude from the estimation results that the first component is the banking-based financial sector while the second is the stock-based financial sector. While the results of the study using multiple linear regression to analyze the effect of the financial development on carbon emissions found that the financial bank-based industry had a negative relationship. In contrast, the stock-based financial sector had a significant positive relationship with affecting carbon emissions. There are many ways that the government can do to make the financial sector contribute to environmental safety, such as offering interest discounts to encourage investment in energy-efficient technologies and asking companies to do CSR in projects that are more environmentally friendly

INTRODUCTION

Climate changes caused by Global Warming have caught the world's attention. Excessive carbon emissions cause as many as 60% of the total greenhouse gases, so they are considered the primary source of climate change (Lau et al., 2014). Many experts say that massive economic growth is the leading cause of increasing carbon emissions, which becomes a challenge for a country.

(Grossman & Krueger, 1991) were the first to find the relationship between economic growth and environmental quality. He explained that the relationship between economic growth and ecological degradation is like an inverted U-curve. The early stages of economic development will cause the environment to use excessive energy. However, when economic growth reaches a peak condition, the quality of the domain will improve again because countries with high economic growth can create technological innovations that are more environmentally friendly. The same research was also found by (Shahbaz et al., 2015) (Hossain, 2012)(Chandran & Tang, 2013)(Nasreen et al., 2020)(Saidi & Hammami, 2015) stated that economic growth and energy consumption are caused by environmental damage. In addition, in Indonesia, research conducted by (Sasana & Aminata, 2019)(Nugraha & Osman, 2019)

also found a positive relationship between economic growth and Co2 emissions.

Increasing economic growth and promoting sustainable economic development are the goals of all countries, including Indonesia; Achieving this requires coordination from all sectors, including the public and monetary sectors. Special attention has to the drivers of economic growth from the monetary side, namely financial development; This started from the global financial crisis that threatened the economic growth of many countries, especially emerging markets and open economies such as Indonesia (Borio & Disyatat, 2011). So economists realized how vital the role of the financial sector is to economic growth.

Previous research found that the financial development and carbon emissions have a positive relationship because the development of the financial system creates more energy demand and consequently produces more pollutant emissions (Bui, 2020) (Boutabba, 2014) (Al-Mulali et al., 2015)(Islam et al., 2013). In addition, a well-functioning financial system can effectively overcome the problem of information asymmetry and expand corporate financing, allowing companies to obtain capital with cheaper costs to expand the scale of production, significantly increasing energy consumption (Sadorsky, 2010). The financial development also attracts foreign investment, which in turn will increase carbon emissions (Dasgupta et al., 2001) (Sadorsky, 2010) (Zhang, 2011). As for consumers, financial development will also make it easier for them to get cheaper credit to buy household equipment such as houses, cars, and air conditioners. So that it will also increase the consumption of carbon emissions which will ultimately affect the environment (Sadorsky, 2010)(Zhang, 2011)(Dogan & Seker, 2016).

However, different research results were found by (Islam et al., 2013) (Boutabba, 2014) (Salahuddin et al., 2015) (Ozturk & Acaravci, 2010) (Liu & Song, 2020). They argue about financial development and emissions. Carbon has a negative relationship because an excellent financial system will reduce borrowing costs. It encourages companies to be more efficient and innovate toward the latest technology that is more environmentally friendly to reduce carbon emissions. (Thangaiyarkarasi & Vanitha, 2021) Answering the differing views of the experts above, he concludes that in emerging market countries, financial development significantly affects carbon emissions, but on the contrary, in developed countries, the relationship becomes insignificant because high economic growth in developed countries causes them to be able to create innovation and use energy that is more friendly to the environment

From previous literature, we can conclude that financial development is vital for consumers or producers in consuming and producing goods. An excellent financial sector such as banking makes it easier for consumers to get cheaper credit, while for producers, it will also help get more affordable borrowing costs. Besides banking, the financial sector development from the stock market will also make it easier for producers to increase investment. However, financial development also led to an increase in energy consumption. This fact raises a dilemma for the government. On the other hand, the government wants to improve the financial sector's performance to encourage

economic growth. Still, on the other hand, the development of the financial sector will also increase energy consumption, resulting in increased carbon emissions.

Indonesia is one of the countries with the fourth largest population in the world (World Research Institute, 2020). The World Research Institute (WRI) in 2020 noted that Indonesia is among the top 10 countries producing the most carbon emissions, ranking 8th with 965.3 MtCO2e or equivalent to 2% of world emissions. This fact implies that Indonesia is one of the contributors to the consumption of carbon emissions globally, where most of Indonesia's greenhouse gas emissions come from the energy sector. Activities of human life cannot be separated from energy consumption to produce household goods such as cars, air conditioners, washing machines, and electricity, so this fact becomes a challenge for the government to improve the environmentally friendly financial sector system.

Previous research has proved more about the EKC hypothesis and associated it with carbon emissions. However, this study uses financial development to influence carbon emissions because financial development is closely related to economic growth. This study uses indicators of domestic credit to the private sector (% of GDP). Domestic credit is provided by the financial sector (% of GDP). Domestic credit to the private sector by banks (% of GDP). Total value of traded stocks (% of GDP) GDP); and Market capitalization of listed domestic companies (% of GDP) as indicators that explain the development of the financial sector. By using multiple linear regression, this study aims to prove whether the financial development will increase the consumption of carbon emissions or even reduce carbon emissions in Indonesia

RESEARCH METHODS

Data

This study aims to explain the influence of financial development on carbon emissions in Indonesia from 1991 to 2020. Financial sector development is a variable that affects carbon emissions because the financial sector significantly impacts economic growth. This fact can from the influence of the global financial crisis, which can potentially destroy the world economy.

This research was conducted through a literature study of data published by the world bank and bank Indonesia. The dependent variable in this study is the number of carbon emissions in Indonesia from 1991 to 2020, while the dependent variable is Domestic credit to the private sector (% of GDP), Domestic credit provided by the financial sector (% of GDP), Domestic credit to the private sector by banks (% of GDP), Total value of traded stocks (% of GDP), and Market capitalization of listed domestic companies (% of GDP) from 1991-2020

Model

This research uses a multiple linear regression model. First uses the Principal Component Analysis technique to change the original variable that correlates with other variables; So that it becomes a small and independent variable to avoid multicollinearity problems or a method to convert variables into small uncorrelated variables while maintaining the original data; this is

previous research found that the indicators used were Domestic credit to the private sector (% of GDP), Domestic credit provided by the financial sector (% of GDP), Domestic credit to the private sector by banks (% of GDP), Total value of traded stocks (% of GDP), and Market capitalization of listed domestic companies (% of GDP); are inappropriate to describe the development of the financial sector because these variables are correlated and give biased empirical results (Tyavambiza & Nyangara, 2015). Moreover, This was done because several previous studies found that the indicators used to represent financial development caused multicollinearity problems when used together in regression analysis (Polat, 2015). The research model in this study is,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \mu i \ldots\ldots\ldots\ldots(1)$$

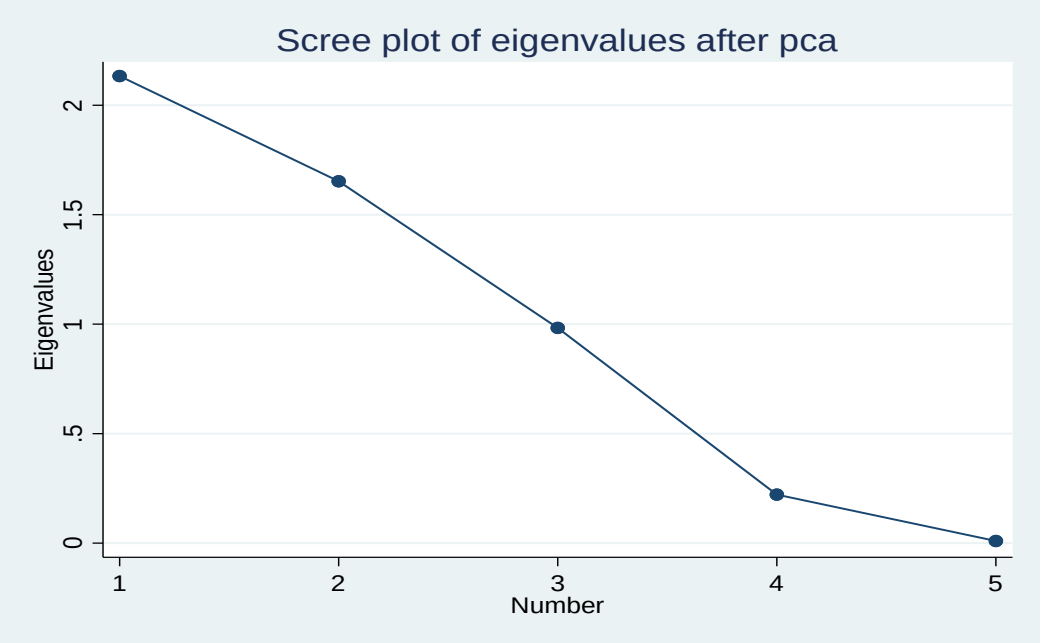
Where Y is carbon emission, defined as burning fossil fuels and making cement in solid, liquid, and gas forms, while X_1 is domestic credit provided by the financial sector covering all loans to various sectors on a gross basis, except credit to the central government, which is net in nature; X_2 is domestic credit to the private sector referring to financial resources provided to the private sector by financial companies, such as through loans, purchases of non-equity securities, and trade credits and other receivables, which form a claim for repayment; X_3 is Market capitalization (also known as market value) is the share price times the number of shares outstanding for a listed domestic company; X_4 is the value of shares traded is the total number of shares traded, both domestically and abroad, X_5 is domestic credit to the private sector by banks which refers to financial resources provided to the private sector by other depository companies (companies receiving deposits except banks central), such as through loans, purchases of non-equity securities, and trade credit and other receivables.

RESULT AND DISCUSSION

Principal Component Analysis

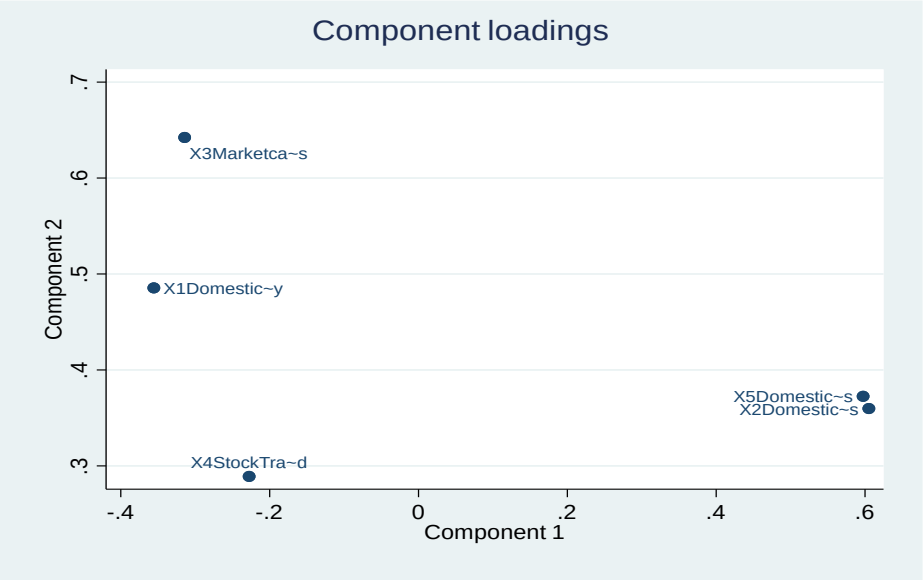
Before estimating multiple linear regression, we use PCA (Principal Component Analysis) to avoid multicollinearity problems when used together in regression analysis (Polat, 2015). PCA analysis aims to convert variables into small, uncorrelated variables while retaining the original data. This is because previous research found that indicators used such as Domestic credit to the private sector (% of GDP), Domestic credit provided by the financial sector (% of GDP); Domestic credit to the private sector by banks (% of GDP); Total value of traded stocks (% of GDP); and Market capitalization of listed domestic companies (% of GDP) are inappropriate to represent financial development. After all, these variables are correlated and give biased empirical results (Tyavambiza & Nyangara, 2015).

Figure 1 Scree plot of eigenvalue



Principal component analysis (PCA) can be done in various ways; the first is by looking at the variance value that is more than 80%, the second is to see if the eigenvalue is more than one, and the third is by observing the screen plot. This study uses eigenvalues. In the picture below, we can see that the five variables that represent financial development are reduced into two components. PCA is beneficial for reducing data, making it easier to interpret the data according to its function. The first component consists of variables Domestic credit to the private sector by banks and Domestic credit to the private sector. At the same time, the second component includes variables Domestic credit provided by the financial sector, Market capitalization of listed domestic companies, and Stock Traded. We can conclude that the first component is the banking-based financial sector, while the second is the stock-based financial sector.

Figure 2. Component Loading Multiple Linear Regression Analysis



The study results using multiple linear regression found that simultaneously financial development affected carbon emissions, which was shown from the results of the F test with a value of 0.000. These results are also supported by an R-square value of 0.6617, which means that 66.17% of all independent variables can explain the dependent variable. Meanwhile, the t-test results found that each component significantly affects carbon emissions in Indonesia or the bank-based financial sector and stock-based financial sector as variables representing the financial sector's development substantially affect carbon emissions. Domestic credit to the private sector by banks and Domestic credit to the private sector as the first component has a negative and significant relationship involving carbon emissions with a value of 0.000, which means that the better the banking sector, the lower the consumption of carbon emissions and benefits the environment. The second component consisting of Domestic credit provided by the financial sector, Market capitalization of listed domestic companies, and Stock Traded, has a significant positive relationship affecting carbon emissions with a value of 0.0000, which means the better the financial market, in this case, the stock market.

Table 1. Estimation results by using multiple linear regression

Source	SS	df	MS	Number of obs	=	28
				F(2, 25)	=	27.40
Model	2.6437e+11	2	1.3219e+11	Prob > F	=	0.0000
Residual	1.2060e+11	25	4.8238e+09	R-squared	=	0.6867
				Adj R-squared	=	0.6617
Total	3.8497e+11	27	1.4258e+10	Root MSE	=	69454

YCO2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
pc1	-56483.51	9151.511	-6.17	0.000	-75331.4	-37635.62
pc2	42505.69	10397.71	4.09	0.000	21091.2	63920.18
_cons	379709.3	13125.56	28.93	0.000	352676.7	406741.9

DISCUSSION

According to previous research, the relationship between carbon emissions and financial development is still unclear. Several studies have stated that when financial development is getting better, it will cause the use of carbon emissions to increase, which will worsen the environment. A well-functioning financial system can effectively overcome the problem of information asymmetry and expand corporate financing. This allows companies to obtain capital at cheaper borrowing costs so that it will expand production scale and will significantly increase energy consumption (Sadorsky, 2010) (Zhang, 2011) (Dogan & Seker, 2016). In addition, increased financial development makes it easier for consumers and producers to save, invest and borrow money, making it easier to buy goods and services that will increase energy consumption. But on the other hand (Zaidi et al., 2019) found that the financial development caused carbon emissions to decrease so that it would save the environment. He argues that this is due to globalization, making it easier for developing countries to transfer environmentally friendly energy from developed countries.

Domestic credit to the private sector by banks and Domestic credit to the private sector as the first component has a negative and significant relationship affecting carbon emissions with a value of 0.000, which means that the better the banking sector, the lower the consumption of carbon emissions and benefits the environment. These results are in line with research found by (Zhang, 2011), which found that financial intermediation or financial institutions had the most significant influence compared to other financial systems such as the stock market and foreign investment; so it proved to be substantial in causing carbon emissions to decrease because bank loans provide strong support for investors to obtain external financing and expand the scale of investment—making it easier for them to get loans so that it is easy to create renewable energy that is more environmentally friendly. However, other studies have found that financial intermediation makes it easier for consumers to buy goods such as cars, houses, refrigerators, air conditioners, washing machines, etc., increasing carbon emissions (Sadorsky, 2010). (Bekhet et al., 2017) also adds that financial development as measured by domestic credit to

the private sector increases energy demand resulting in environmental degradation

The second component consists of Domestic credit provided by the financial sector. The market capitalization of listed domestic companies, and Stock Traded, has a significant positive relationship affecting carbon emissions with a value of 0.0000, which means the better the financial market, in this case, the stock market; This causes the consumption of carbon emissions to increase, which can damage the environment. Financial development such as the stock market forces companies to get more liquidity, expand output, and increase energy consumption. Therefore, CO2 emissions also increase (Abbasi & Riaz, 2016). This result is supported by (Dasgupta et al., 2001). Companies listed on the stock market tend to get funding at lower costs making it easier to invest in new projects and increasing energy consumption and carbon emissions.

(Zhang, 2011) said that policies in financial markets such as the stock market that are not good are also the cause of a positive relationship between financial markets and carbon emissions; This is because the stock market characteristics in developed and developing countries are very different. In developing countries, the stock market system is not very good, so market mechanisms are not standardized, such as a lack of transparency and consistency. Besides that, political influence also has an effect, and lastly, corporate finance in the stock market is not fully used for effective, productive projects. However, different findings were found (Thangaiyarkarasi & Vanitha, 2021); he found that the financial market, which in this case is the stock market, has a better influence on carbon emissions because the listed companies are closely monitored by the financial authority institution where they are required to carry out corporate social responsibility in terms of environmental protection and utilization and more advanced technology that can improve energy efficiency and reduce carbon emissions. On the other hand, companies obtaining loans from financial institutions are not very closely monitored by financial authority institutions, so that they have less motivation to protect the environment; This is supported by (Tamazian et al., 2009), which state that financial developments help companies listed on the stock exchange to improve energy efficiency by adopting new technologies. (Haas & Popov, 2019) suggest that the stock-based financial sector relationship could be negative if the stock market reallocates investment to less polluting sectors. In addition, it can also encourage carbon-intensive sectors to develop and implement technologies that are more environmentally friendly

The regression analysis results are due to differences in country characteristics. Whether the country is in the category of a developing country or a developed country (Acheampong, 2019)), the development of the financial sector can have a better impact on carbon emissions in countries with relatively better financial sectors. In addition, developed countries are adopting better technologies, which enable them to realize economies of scale in the production process and create lower levels of pollution(Tamazian et al., 2009). Indonesia is a developing country where transactions on the stock market are not as many as transactions with financial institutions or banks. This condition to the fact that Indonesia is not included in the ranking of the top 100 countries on the list

of the Global Financial Center Index, which describes an aggregate index of five main areas: "business environment, "financial sector development" "infrastructure factors" human capital. So it is very reasonable to find a negative relationship between the development of financial institutions and carbon emissions and a positive relationship between the financial market (stock market) and carbon emissions; This is because transactions in the stock market are not large enough, so they have not contributed much to the findings or innovation to the latest environmentally friendly technology.

There are many ways the government can contribute to environmental safety for the financial sector, such as offering interest discounts to encourage investment in energy-efficient technologies (Boutabba, 2014). In addition, companies that finance financial markets, such as the stock market, are also required to carry out CSR in more environmentally friendly projects (Thangaiyarkarasi & Vanitha, 2021). The critical point here is that the government as a policymaker must show a real desire to improve and develop a financial system for promising local and international investors to projects that are more environmentally friendly (Charfeddine & Kahia, 2019)

CONCLUSION

Understanding the determinants of energy consumption in developing countries is a topic of much research lately, where economic activity is considered the main driver of CO2. This study looks at the relationship between financial development and carbon emissions. Using the PCA technique, the study found that the independent variable was reduced into two components. The first component consists of variables Domestic credit to the private sector by banks and Domestic credit to the private sector. At the same time, the second component includes variables Domestic credit provided by the financial sector, Market capitalization of listed domestic companies, and Stock Traded. While using multiple linear regression analysis, this study found that Domestic credit to the private sector by banks and Domestic credit to the private sector as the first component had a negative and significant relationship affecting carbon emissions. In contrast, the second component consisted of Domestic credit provided by the financial sector. The market capitalization of listed domestic companies and Stock Traded have a significant positive relationship affecting carbon emissions.

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