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The Green Finance Stress in Indonesian Banking Finance

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ABSTRACT

This study aims to account for the banking sector intermediary to increase the environmental function by green finance in Indonesia. Using the development model of the Ed Waves Index with time series data and grouped quarterly from 2019 to 2021 obtained from the Annual Reports of Bank Indonesia and the Financial Services Authority (OJK). There are 2 waves that give a positive reaction (effective) at the first period (GF 0.008 amplitude) and the fourth period (GF -0.022 amplitude). On the other hand, two waves gave a negative reaction (ineffective) at the second period (GF - 0.011 amplitudo) and the third period (GF 0.019 amplitudo). Therefore, the green finance cycle has a sensitive behavior for the intermediary banking sector due to the effect of macroeconomic shock, and because of that, the green finance cycle movements cannot support financial stability and economic growth effectively in Indonesia. This research can serve as a new model for both theoretical and empirical studies in the field of economics. This result can also be a measuring tool for Bank Indonesia and the banking sector in determining financial policies regarding economic indicators to anticipate acute financial depression due to increasing financial sensitivity. This study contributes to the classical theory and the velocity of money theory development in relation to financial activities measured based on the banking intermediary function.

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1. INTRODUCTION

Currently, green finance is a world problem. The banking ability concept to provide loans is still low (Wang et al., 2023; Dikau and Volz, 2021; Christy and Tjun, 2024). Climate change does not only disrupt economic activities in creating financial stability and economic growth (Islam et al., 2014; Akomea-Frimpong et al., 2022) but can also damage several financial structures in a country (Khalatur and Dubovych, 2022; Masukujjaman and Aktar, 2014; Sachs et al., 2019). Changes in environmental behavior due to climate change are greatly affecting the world economy, one of which is research conducted by the Swiss Re Institute, found that there is a decline in world capacity in GDP will shrink by 18% in 2050, influenced by global heat, which will increase by 3.2°C. This influence strength could damage the world financial cycle (Taghizadeh-Hesary and Yoshino, 2020). In line with findings by the World Economic Forum (WEF), which explains that the world will experience a decline in economic capacity of 10% in 2050 due to climate change, which is damaging the global financial interaction process, it is the main agenda in discussions at the G-20 with the aim of maintaining environmentally based financial ecosystems throughout the world (Rakić and Mitić, 2012; Basmar et al., 2021; Shakil et al., 2014).

The banking sector provides loans to industries that have production goals by collaborating with environmental sustainability functions (Kamran et al., 2020; Z. Chen et al., 2022; Baharudin and Arifin, 2023). The relationship between banking sector development is due to the fact that the world is experiencing many shifts in functions and goals in the interaction process between the environment and other sectors (Basmar et al., 2022). Environmental damage occurs due to a lack of awareness in protecting and maintaining environmental sustainability (Mir and Bhat, 2022; Leliana and Yenni, 2024). In economic theory, natural resources are ecosystem resources in the creating process and fulfilling supply and demand functions in the economy flow, resulting in climate change or what is known as climate change (Zhou et al., 2022; Ye et al., 2022; Wang and Zhi, 2016).

Financial instability in the banking sector is evidence of the banking sector's weakness in facing pressure from macroeconomic variables. This pressure has a multiplier effect on other financial performance, measured by the pressure magnitude and the financial speed reactions in response to pressure (Rasoulnezhad and Taghizadeh-Hesary, 2022; Md. Shafiqul Islam, 2013). The heavier of pressure caused by the banking sector becomes stronger turbulence, leading to financial depression based on the movement size of the financial cycle during the financial crisis. The inability to the pressure respond from macroeconomic variables indicates that optimizing banking performance is the main determinant in creating positive financial flows (Dörry and Schulz, 2018; Ullah, 2013; Lindenberg and Volz, 2016).

This research analyzes the financial cycle in the banking sector specifically, because several previous studies focused on the ability to use finance based on alternative loans from other financial institutions, but structurally the most active financial cycle is in banking activities. Several previous studies revealed that the financial crisis cause was due to the banking sector performance (J. Chen et al., 2022; Mikael Backman, 2011; Ashari and Nugrahanti, 2024). The emphasis in this research is the relationship between banking performance sensitivity in relation to maintaining environmental sustainability, both nationally and internationally.

This research aims to find out the banking sector's ability to maintain the green finance cycle flow, when there are pressures from macroeconomic variables that influence the financial system's performance and to know how the banking sector maintains financial synergy through the green finance cycle flow in the long term, especially against potential financial crisis pressures that can affect financial stability and economic growth.

2. METHODS

In answering the problem gap, the data in this research uses time series secondary data and grouped quarterly from 2019 to 2021 which a total of 105 banks in Indonesia, consisting of 92 conventional banks and 13 sharia banks, and collected based on annual financial reports presented by Bank Indonesia and the Financial Services Authority. The data is processed using a measurement model based on the Ed Waves Index development model (Basmar et al., 2022 ; Dikau and Volz, 2021). This model is able to explain precisely the pressure and duration amount of financial cycle waves based on the wave movement period.

Green finance in this research uses the financial pressure construction from changes in supply and demand pressure in financial activities. This measure will be transformed based on the banking intermediary function through financial turnover in banking activities. This reaction in theory will move with a normal balance value. This situation is shown through the following equation:

$$\alpha = \beta \quad (1)$$

Balance and stability in Equation 1 are interpreted from the existence of financial stability and balance in financial flows. This measure is based on banking intermediary reactions as seen in the Ed Waves Index developed model of the entire system (Equations 2-8).

$$\alpha = \frac{\sum \eta + \sum \mu + \sum \gamma}{3} \quad (2)$$

$$\beta = \frac{\sum \phi + \sum \varphi + \sum \vartheta}{3} \quad (3)$$

$$\left(\frac{\sum \eta + \sum \mu + \sum \gamma}{3} \right)^s = \left(\frac{\sum \phi + \sum \varphi + \sum \vartheta}{3} \right)^s \quad (4)$$

Where savings (η), current accounts (μ), deposits (γ), working capital credit (ϕ), investment credit (φ), and consumption credit (ϑ).

Furthermore, the pressure Wave Green Finance (WGF) magnitude is described based on calculations in the following equation:

$$WGF^+ = \alpha_{(1 < GF)} < \beta_{(1 < GF)} \quad (5)$$

$$WGF^- = \alpha_{(-1 < GF)} > \beta_{(-1 < GF)} \quad (6)$$

Finally, construct wave changes in classification are measured through the following equation:

$$GF^+ = \left(\left(\alpha \cdot (\sum \rho \cdot \sum \sigma \cdot \sum v) \right) + \left(\beta \cdot (\sum \rho \cdot \sum \sigma \cdot \sum v) \right) \right)_{(1 < GF)} \quad (7)$$

$$GF^- = \left(\left(\alpha \cdot (\sum \rho \cdot \sum \sigma \cdot \sum v) \right) + \left(\beta \cdot (\sum \rho \cdot \sum \sigma \cdot \sum v) \right) \right)_{(-1 < GF)} \quad (8)$$

Model Equations 7 and 8 determine how deep and how strong the banking intermediary function reaction is able to create financial stability, and the process of achieving green finance stability can run sustainably. Additionally, the sustainability process involves financial activities

through the financial cycle waves in improving green finance in particular and maintaining environmental sustainability as well as increasing financial stability and overall economic growth.

3. RESULTS AND DISCUSSION

In **Figure 1**, as a research construction diagram, from the two waves movement between banking intermediaries and the green finance wave, there are four wave peak points that experience strong pressure, in line with changes in financial activity in the financial market, which have an effect on the pressure, duration, area, and wave pattern in both financial activity in the banking and green finance sectors in each measurement period.

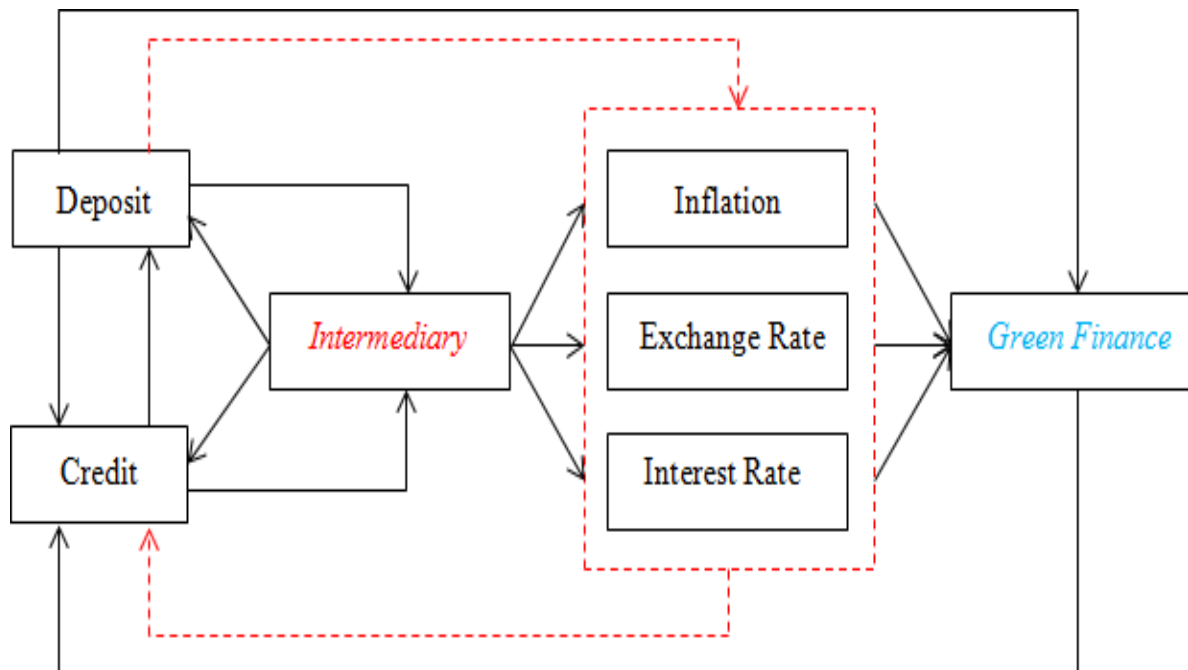


Figure 1. Green Finance Flow Construction.

Under the green finance construction, green finance stress is formed from financial circulation in the banking sector through internal and external financial pressures (Wang et al., 2023). The transformation of financial pressure turbulence results in instability from financial supply (deposits) and demand (credit) for the banking intermediary function. The findings of this study confirm the equilibrium theory by Adam Smith (1776). First, financial equilibrium through the interaction of financial supply and demand in stimulating financial activities in the banking sector has a high sensitivity (J. Chen et al., 2022). Second, this study also shows that banking sector pressure has a strong contribution to the interaction of macroeconomic elements (inflation, exchange rate, and interest rate) (Ye et al., 2022). Third, the financial pressure contraction causes a stress effect on the banking sector's ability to increase green finance in financial flows (Taghizadeh-Hesary and Yoshino, 2020). In such cases, this condition results in a financial crisis that has an impact on the damage to the financial ecosystem and the environmental ecosystem through the relationship of circulation in financial flows with high levels of stress (Basmar et al., 2022).

Furthermore, financial flows in banking activities form a positive relationship with changes in the financial cycle. The measurement of the magnitude pressure and the financial activity movements duration is the main basis for determining financial policy. In this context, the relationship between financial interactions that form stress pressure in the banking sector shows

that financial flows fluctuate in line with theory of money quantity by Irving Fisher's (1967). These findings confirm that green finance experiences a strong contraction in financial flows through the turbulent effects of macroeconomic pressures (Dörny and Schulz, 2018). First, the financial flows concentration in the banking intermediary function experiences strong stress through the turbulent effects of external pressures (Mir and Bhat, 2022). Second, changes in banking financial behavior in increasing green finance are hampered because internal financial pressures contribute to the slowdown in financial channels through financial circulation in industrial sectors oriented towards increasing green finance (Akomea-Frimpong et al., 2022)

In general, the financial movements in this study serve as a model for identifying financial pressures in determining future policies. Thus, the resulting financial stress serves as a model for anticipating the financial crisis pressures. Policies developed based on the research results serve as mitigation strategies for the pressures of financial and environmental crises. Meanwhile, determining appropriate policies through calculating the financial movement pressures that negatively impact for economic growth and development, as a preventative measure against the banking sector's green finance, is a priority in this research.

This research is more comprehensive, as a framework of thought presented in **Figure 1** shows that the banking intermediary function stability can be a basic measure in knowing the main elements of the green finance cycle, because *first*, when financial stability receives positive stimulation, the reaction that will occur is an increase in economic growth. *Second*, when the level of financial stability receives negative stimulation, it will have an impact on the level of very acute financial depression.

This research also introduces the financial stimuli effects, both positive and negative, arising from changes in the overall pressure of economic variables. According to the theory, financial stress reactions drive the financial cycle wave movement in the direction of the pressures that influence them. Consequently, changes in the waves can determine the extent of risk, and the impacts of these changes can be well identified.

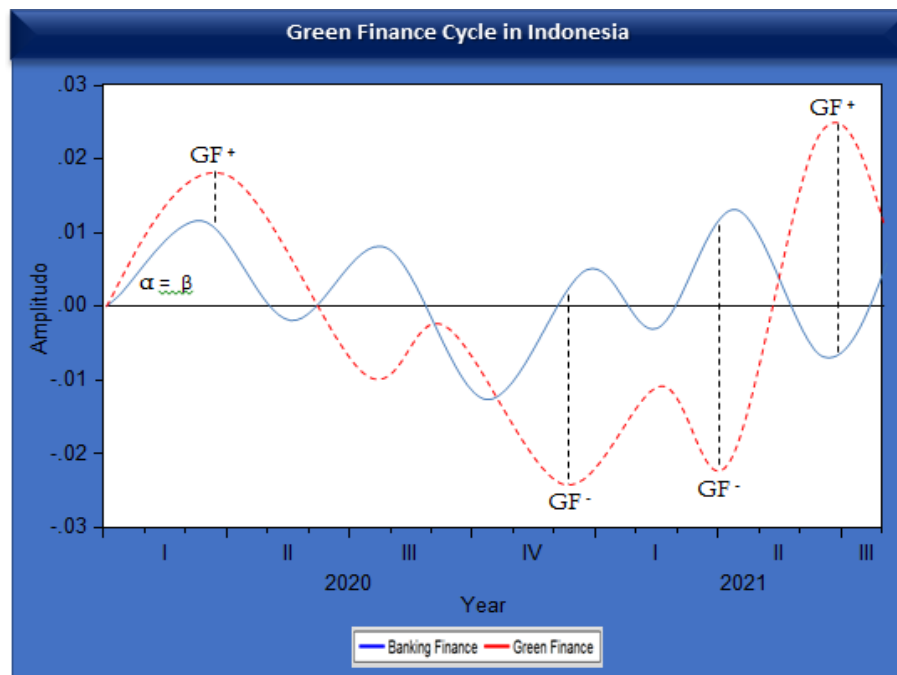
The variable selection in this study in **Figure 1** is demonstrated through the financial activity movement as measured by the financial circulation of the banking sector, which can directly impact the financial sector, the industrial sector and the community that carries out financial activities based on green finance objectives. Moreover, financial interactions were found to be unidirectional with the overall financial circulation (**Figure 2**). Therefore, the financial flows are linked with fluctuations that move based on the financial stress of each financial circulation.

In addition, the stability response based on the financial cycle wave through macroeconomic variable pressures, broken down into inflation, exchange rates, and interest rates, demonstrates the banking sector's ability to manage financial stress. Therefore, this research indicator provides an important basis for measuring the financial stress speed, which can easily influence the financial cycle wave.

Therefore, the changing pressure effects based on the identification of financial cycle waves indicate that the relationship between banking intermediary performance and macroeconomic variable pressures has a positive impact on the sustainability of green finance's long-term performance. Therefore, based on financial flow measurements, this study provides a comprehensive overview of consistent financial activity and also serves as an indicator of the financial cycle waves' movement in the optimal green finance process.

The synchronization effect between the two pressures shows the effectiveness of financial flows from the banking sector, which can be absorbed in the process of achieving green finance targets, with the industry involvement concept in the finance use as an environmental preservation process. Effectiveness shows how strong the banking sector financial flow is in

creating a positive relationship between financial functions and the environment through the credit use in the industrial sector, based on the pressure amount in stimulating a positive financial cycle, both in the long and short term. The relationship size can be shown in **Figure 2**.



Source: Processed data, 2025

Figure 2. Green Finance Cycle in Indonesia.

The measurement results found that the financial activity wave in the banking sector's financial performance showed that pressure was fluctuating, where financial pressure moved slowly based on a strong level of prudence. Overall, the wave reaction showed that there was financial stability, both in the long and short term.

Identify the wave movement in the banking sector's financial performance, generally moving with a pattern of dynamic change duration, the change culture in wave movements has the same duration on average, indicating that the financial change process in the banking intermediary function occurs in the same quantity in each period.

Most of the waves move in positive and negative areas proportionally, which shows that financial flows have a very strong balance based on the banking intermediary function. The movement direction of the financial cycle pattern is towards a high level of effectiveness, based on the waves' steepness, most of which do not have a deep degree of any pressure, either when there is an increase in pressure in financial flows or when there is a fairly strong financial depression.

Another financial activity measurement based on the green finance waves movement found that the waves fluctuated freely using a measure of financial pressure, which shows that green finance pressures tend to experience strong depression. Even though some pressures show an increase, this situation indicates that the pressure tendency to respond to financial activity is negative. A negative green finance response indicates that financial flows provided by the banking sector do not have a positive impact on financial stability or economic growth.

The duration size of the green finance wave has not changed. On average, the wave movement has the same magnitude of change, indicating that the green finance response has not changed with a balanced level of dynamism in each period. The green finance wave movement area shows

a poor level of effectiveness, indicated by the wave movement being in the negative area, changes in financial activities towards improving the environment become less effective.

The pressure character, duration, and financial activity movement area through the intertwined relationship between financial performance waves in the banking sector and green finance waves overall show that the green finance cycle movement has a negative relationship with financial stability and economic growth in Indonesia. This situation can be seen via **Table 1**.

Table 1. Measuring the green financial cycle in Indonesia

Period	$\Sigma\alpha + \Sigma\beta$	Pressure	GF	Duration Period	Area	Reaction
		WGF				
I	0.011	0,019	0.008	5	Positive	Effective
II	0.003	(0.025)	(0.022)	6	Negative	Ineffective
III	0.012	(0.023)	(0.011)	2	Negative	Ineffective
IV	(0.007)	0.026	0.019	4	Positive	Effective

Source: Processed data, 2025

The description of the green finance phenomenon in Indonesia indicates that financial activities within the banking sector undergo dynamic movements characterized by balanced movement patterns and fluctuating pressure patterns. This reaction causes different effects based on the continuous financial movement period and has a strong influence on the financial circulation process in achieving green finance goals in Indonesia.

The first, wave reaction shows that financial pressure in the banking intermediary function moves by 0.011 amplitude. This pressure is directly proportional to the green finance wave pressure of 0.019 amplitude. The reaction effect shows that the credit distribution majority by the banking sector has a positive influence on increasing environmental sustainability. The green finance wave reaction shows a pressure of 0.008 amplitude over 5 measurement periods with a tendency for the wave movement area to be positive. Therefore, the financial flows use is effective in increasing green finance programs for financial activities in Indonesia.

The positive reaction of financial flows shows that financial activities in the banking sector for increasing green finance have the maximum effect through synchronization between the banking sector's ability to increase savings, which has an impact on the banking credit distribution in the industrial sector, which has a positive impact on environmental preservation in Indonesia.

This also corroborates the findings of [Ullah \(2013\)](#), which indicate that the financial synchronization power effect through banking intermediary function policies shows a positive reaction to green finance through the financial offerings' effectiveness in the banking sector. The positive financial reaction encourages increased credit distribution to industrial sectors oriented towards improving environmental ecosystems.

Financial performance drives turbulent economic growth with the stability of macroeconomic elements such as interest rates, which directly influence financial absorption in the industrial sector and society.

Green finance in this period implements financial stability and economic growth and is strengthened by the findings carried out by Lindenberg and Volz (2016), Ye et al. (2022), and Md. Shafiqul Islam (2013). Therefore, the industrial sector increases loans to the banking sector, which can provide benefits for both parties in the banking sector by increasing credit by increasing income and banking soundness. Besides that, banks can control the overall financial activity pace. Meanwhile, in the industrial sector there is also an increase in income by carrying out company operations based on financial loans from banks. The increase in the industrial sector

performance has a positive impact through better capabilities. Therefore, increasing profitability can make it easier to repay loans and interest that have been given by the banking sector

The second, wave depicts the pressure on the banking intermediary function moving at 0.003 amplitude. This pressure is inversely proportional to the pressure on green finance at -0.025 amplitude. The reaction effect shows that credit distribution has no effect on environmental sustainability. The green finance wave reaction is -0.022 amplitude for the 6 measurement periods, with a tendency for movement areas to negative values. Therefore, financial activities have not been effective in the green finance program in Indonesia.

These findings are in line with the statement by Akomea-Frimpong (2022) and Mir and Bhat (2022), which states that financial conditions during this period experienced a decline in the banking sector, impacting the green finance achievement in the industrial sector due to changes in general economic conditions marked by macroeconomic pressures from high inflation, which has a shock effect on the banking intermediary process. The credit granting process experienced a slowdown, which lasted for a long time, resulting in a strong simultaneous effect on the overall process of achieving green finance.

Furthermore, this finding aligns with the view of Zhou et al., (2022), who argued that financial stress stimulates banking sector performance through external pressures. This indirectly influences financial imbalances. This imbalance results in instability in the financial function and serves as an indicator of both financial and environmental crises simultaneously.

There was a decline in green finance performance through the finance use in the banking sector, resulting in a strong and deep contraction with a long duration pressure, resulting in financial depression and the green finance program failure in the industrial sector. Delays due to external and internal pressure have a strong influence on financial circulation. Therefore, the non-performing loan risk becomes large and results in a financial crisis. The decline in performance makes it difficult for the banking sector to maintain intermediary functions and poses risks to banking soundness.

The third, wave shows the banking intermediary function moving by 0.012 amplitude, inversely proportional to the green finance wave of -0.023 amplitude. The reaction effect shows that the credit distribution majority has no effect on environmental sustainability. The green finance wave reaction was -0.011 amplitude for 2 measurement periods with negative movement areas. Financial activities have not been effective in increasing the green finance program in Indonesia.

Indirectly, this research reveals the heavy pressure on the banking sector in financial activities. The balance period forms a crystallization of pressure that has a long-term impact, making banks careful in channeling credit to the industrial sector, in line with research conducted by Wang (2023), Rasoulinezhad and Taghizadeh-Hesary (2022), and Zhou (2022). On the other hand, the industrial sector is under strong pressure from changes in macroeconomic indicators and experiences a shock to operational income. This effect causes changes in financial circulation and affects banking soundness.

This conclusion extends the findings of Khalatur and Dubovych, (2022), indicating that in an open economy, the risk of financial stress increases. The reaction effect of financial stress pressures can lead to long-term financial crises. Therefore, policy implementation in the financial system in the banking sector requires flexibility in regulating financial flows in the intermediary function.

Green finance reacts strongly to changes in banking performance, negative effects have a strong impact on financial turnover through the intermediary function. Based on the strength of the financial shock process in the previous period, which had long-term effects, the severity of

the pressure resulted in reactions accumulating in strong vibrations, which shifted the goals in achieving the green process finance.

The severity of the shock resulted in the banking sector's risk through non-performing loans also increasing. Therefore, the banking sector was careful in disbursing credit, and some banks, in order to achieve profitability, disbursed credit to the industrial sector, which did not have a program to increase environmental sustainability in the previous period. The tension effects make it difficult for banks to return to normal conditions, because banking soundness has experienced a maximum decline due to financial activities that have a negative impact on the banking sector and industrial sector, which is the basis for measuring the green finance cycle in Indonesia.

The fourth, wave indicates a movement intermediary function of -0.007 amplitude, inversely proportional to the green finance wave of 0.026 amplitude. The reaction effect shows that credit distribution has a positive effect on increasing environmental sustainability. The green finance wave reaction was 0.019 amplitude over the four measurement periods with the movement area being positive. Therefore, financial activities were effective in improving the green finance program in Indonesia.

The effect of increasing negative financial pressure causes financial performance to change significantly, pressure turbulence becomes a reference for the banking sector in responding to previous pressure shocks. The intermediary function movement with a strong contraction in the economy is due to careful credit distribution which has a positive effect on financial flows, especially in the industrial sector which focuses on increasing environmental sustainability. Contra performance results in maximum growth and financial stability, even though there is financial pressure on macroeconomic indicators.

This conclusion is consistent with the findings of Z. Chen et al., (2022), which suggest that banking performance in carrying out its intermediary function needs to be supported by policies that can reduce financial stress levels. Changes in internal and external financial pressures will influence the optimal achievement of green finance.

Green finance shows maximum improvement despite strong pressure on financial flows in the previous period. On the other hand, this research shows that the effectiveness of the banking sector's financial performance has been maximized, marked by a shift in the intermediary function that increases the green finance performance in preserving the environment in Indonesia. The positive effect of financial interactions shows that financial activities in achieving green finance have strong circulation, but when there is strong macroeconomic pressure, the negative response has an impact on the intermediaries' function and the industrial sector in creating environmental sustainability in Indonesia.

This research is in line with Masukujjaman and Aktar (2014), Baharudin and Arifin (2023), and Kamran et al., (2020). Overall, there is a positive relationship between the banking sector performance in improving the intermediary function and increasing the industrial sector performance in ensuring environmental sustainability, but when there are strong macroeconomic pressures, then financial stability runs well, but there are negative reactions in the industrial sector with strong pressure on financial performance. This element will dampen maximum economic stability and growth. The financial cycle flow experienced obstacles based on pressure from financial activity even though the banking sector responded positively and the industrial sector responded negatively to financial stability and economic growth in Indonesia.

Therefore, the green finance cycle in the Indonesian economy has dynamic pressure, where the banking function performance has stable financial behavior even though macroeconomic

pressures respond positively, while on the other hand, the industrial sector works optimally when economic pressures do not provide a strong shock to financial flows in Indonesia.

4. CONCLUSION

The green finance cycle in Indonesia has a high sensitivity to financial activities in the banking sector through the intermediary function. This effect shows that the banking sector uses the prudence concept in the industrial sector, when macroeconomic pressures are strong, financial activity weakens and banks find it difficult to maintain financial stability in green finance programs. This reaction is supported by the pressure pace on green finance through a negative response that suppresses long-duration waves, causing the banking sector to experience a significant increase in non-performing loans.

Monetary policy control over macroeconomic sensibility is a solution in anticipating and reducing financial stress. Through effective monetary policy, it will directly reduce the green finance amplitude pressure in the banking sector. The green finance wave contraction on the financial activity wave in the banking sector shows that the green finance cycle tends to respond negatively with a high risk of decreasing soundness levels. Therefore, the green finance cycle in Indonesia has not been able to maintain financial stability and optimal economic growth. Therefore, the results of this study can be further developed by developing a measurement model by adding more complex internal and external financial elements, both nationally and internationally.

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