

Impact of FED Rate and Energy Commodity Price on ASEAN Sustainable Stock Returns

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ABSTRACT

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Sustainable stocks have been associated with low risk and low returns but can be a good longterm investment portfolio option. After COVID-19 and the Russia-Ukraine conflict, the global economy has been destabilized, leading to an increase in the FED rate and energy commodity prices, such as crude oil and crude palm oil (CPO). This study aims to examine the impact of these indicators on the returns of sustainable stock indexes in emerging markets such as ASEAN, specifically the member of ASEAN who have sustainable stock indexes i.e. Indonesia, Malaysia, Singapore and Thailand. Based on 475 research data, the study finds that crude oil and CPO prices have no significant effect on sustainable stock returns. In contrast, the FED rate has a significant negative effect on sustainable stock returns. Sustainable stocks appear to be resilient to crude oil and CPO price volatility, except for the FED rate. Therefore, investors may be less concerned about energy commodity price volatility in the post-COVID-19 period. However, investors seem more interested in shifting their investments to bank products with higher profit opportunities due to the FED rate increase and minimal risk.

1. INTRODUCTION

The Sustainable Development Goals (SDGs) aim to improve the economy and welfare of society without damaging the environment. The SDGs improve people's welfare, maintain the sustainability of people's social lives, and preserve the quality of the environment from generation to generation. The private sector's contribution is necessary for countries to achieve sustainable development [1]. Consequently, the company will be able to improve its performance, increase shareholder wealth and enhance its image as a company that cares about the balance between people, planet and profit (triple bottom line).

Studies on the SDGs are still growing until now, and there is still room for further studies to be developed. One of the studies that still needs to be developed is the study of the relationship between the global economic crisis and environmental, social and governance (ESG) issues in sustainable finance. Previous studies have not directly explained the impact of monetary policies such as interest rates and energy commodities on sustainable finance, especially in the ASEAN region (see next paragraph). Thus, studies on the impact of globally influential bank interest rates (e.g. FED rate) and energy commodities (e.g. crude palm oil and crude oil) on sustainable stock returns in the ASEAN market need further investigation. In addition, few studies examine the impact of the global economic crisis on ESG and sustainable stock index in ASEAN using panel data.

The challenge in implementing sustainable finance is the

assumption that sustainability contradicts modern portfolio theory. Companies implementing sustainability in their operations will require higher costs and could reduce shareholder returns [2]. Another scholar explained that between 2017 and 2020, there was a negative perception of investing in companies that implemented ESG principles [3]. Sustainable stocks in some previous studies were identified with low-risk [4]. According to the risk-return trade-off theory in the securities market, lower-risk assets offer lower returns. However, although sustainable stocks have low risk, they have excellent portfolio markets [5]. Some research results during the COVID-19 crisis indicated that there were investors who shifted their interest from conventional stocks to ESG stocks [5-9]. The shift in investors' choices can be explained by prospect theory. Investor choices between risk and return are based on investor preferences, especially when faced with uncertainty in times of crisis.

After the economic crisis caused by COVID-19, 2022 experienced another economic crisis caused by the conflict between Russia and Ukraine. According to the World Bank, Russia's invasion of Ukraine disrupted global energy markets and threatened the global economy [10]. Africa was among the economies shocked by the Russia-Ukraine conflict, which sent shockwaves through global stock markets [11].

This crisis was caused by the demand and supply shock after COVID-19. In response, many central banks have issued a policy to raise interest rates. The Federal Reserve System (FED). As the central bank in the United States is very influential on the global economy, any policy issued by the

FED will usually affect global financial conditions. Therefore, it is natural that the FED's policies often have a different sentiment for the securities market. Scholars showed that a top-down analysis of a company's prospects must start with the global economy [12].

FED rate volatility also has an impact on stock market returns in the Asia-Pacific region, including ASEAN [13]. Using financial data in 2020 at the peak of the COVID-19 pandemic, it was found a significant difference in stock returns before and after the FED announcement [14]. Other scholars found a negative effect of US interest rates on the selected ASEAN stock markets during periods of economic expansion, but this effect disappears during periods of economic crisis [15]. During COVID-19, most countries published a policy of lowering interest rates; however, during the 2022 crisis, most countries increased their interest rates, including the FED. The FED rate during the COVID-19 crisis fell to 0.05% in March 2020 and remained there during the COVID-19 pandemic crisis. On the contrary, in the post-COVID conditions, the FED rate increased to 1.58% in June 2022. This increase led to disruptions in capital outflows and affected the capital market, leading to a decline in stock market returns.

The same happens with the difference in crude oil price fluctuations during COVID-19 and post-COVID-19. During the COVID-19 crisis in April 2020, the price of West Texas Intermediate (WTI) crude oil reached its lowest price at US\$18.84 per barrel, while in the post-COVID-19 period in April 2022, there was an increase to US\$104.69 per barrel. Similar to the FED rate, the price of crude oil is a source of information that influences the capital market. Supply and demand shocks occur not only in crude oil but also in crude palm oil (CPO). During the COVID-19 pandemic, CPO prices fell. For example, the price of CPO oil at CIF Rotterdam reached only US\$525 per ton in April 2020, then increased to US\$1,765 per ton in April 2022. Similar to crude oil, CPO commodity prices can affect share prices [16].

The random walk theory explains that stock prices are not based solely on historical data movements but are also influenced by current information and can fluctuate in response to market conditions. Furthermore, the Efficient Market Hypothesis (EMH) suggests that stocks reflect all available information. Thus, changes in FED interest rates, crude oil prices and CPO prices can affect stock prices and stock returns.

Prospect theory explains that investors may shift their investments to another low-risk asset, such as deposits, which earn interest based on the central bank's interest rate. In other words, the increase in the FED rate may cause investors to shift their funds into a low-risk investment as they become more risk-averse. The rise in commodity prices, such as crude oil and CPO, provides valuable information for investors to find better opportunities for higher returns. Investors may have enough information to decide whether to shift their funds from ESG stocks to energy commodities or assets with less exposure.

The 2022 global economic crisis can be an opportunity or a threat for companies to apply sustainability principles. Based on the resilience of sustainable and ESG index companies during the COVID-19 crisis in 2020-2021, this category of stocks has a lower risk during the crisis period, so investors will not over-speculate and shift their funds to other assets in the 2022 crisis. On the other hand, the demand for sustainable stocks may increase if the rise in the FED rate, crude oil and CPO becomes a sign of increased risk, causing investors to

shift their funds to low-risk stocks such as ESG or sustainability stocks. However, will the resilience of sustainability stocks be replicated in the post-COVID-19 economic crisis, or vice versa? Based on prospect theory and random walk, investors might not consider information about the resilience of the sustainability and ESG stock index during the COVID-19 crisis in 2020-2021. Investors only consider information about uncertain conditions and risks during the post-COVID-19 crisis in early 2022, such as the impact of the Russia-Ukraine conflict.

Previous studies (see previous section) found that during the COVID-19 crisis period from 2020 to 2021, investors reacted positively and shifted their investments to ESG and sustainability stocks as the FED rate, crude oil, and palm oil prices declined. In contrast, during the post-COVID-19 economic crisis period in early 2022, all three indicators experienced a significant increase in value. The post-COVID-19 economic crisis 2022 affects the European region and other regions, including ASEAN countries. For example, many countries struggle with high fuel prices and CPO derivatives. Based on the FTSE ASEAN all-share ASEAN stock market, on January 3rd, 2022, it was at 932.14 and continued to fluctuate at its highest on February 17th, 976.61 and the lowest on June 23rd, 828.16. There is a downward trend in the ASEAN stock market.

Based on the above statement, a research question arises regarding the effect of FED interest rates and energy commodities (crude oil and palm oil) on the investment returns of sustainable stocks. Therefore, this study attempts to fill the gap by testing the resilience of sustainable stock indices in the ASEAN market in response to fluctuations in FED interest rates, crude oil prices and CPO. In other words, it is necessary to test the resilience of sustainable stocks in the face of an increase in these three indicators of economic crisis.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) argues that market prices "fully reflect" available information. Security prices reflect all information available to investors about the value of the security [17]. Efficient financial markets process the information available to investors and incorporate it into the prices of securities. Market efficiency has two general implications. First, the return on a stock depends on existing and new information in the market at any particular time, and second, investors who use the same information as the market cannot expect to benefit [18].

There are three versions of the EMH for stock prices [12]. First, the weak assumption is that share prices reflect all past price history. Second, the semi-strong assumption is that all publicly available information about the company's prospects is already reflected in the share price. Thirdly, the strong assumption concerns the state of an efficient market, where stock prices reflect all information relevant to the company, including information only available to company insiders. For example, in the Indonesian capital market, the weak assumption is that global economic information such as the FED rate, crude oil prices, and CPO will more easily affect stock prices [19-21].

Literature studies explained that empirical evidence on the

efficiency of financial markets, both locally and internationally, provides evidence that the right information from financial markets plays an important role for participants to make optimal decisions in choosing which securities to buy [22].

2.2 Random walk theory

The theory of random walk discusses the change in market price stock has no memory and cannot be predicted by historical data or price behaviour. The long and short-term economic time series are oscillatory movements and random fluctuations due to various causal influences [23]. A random walk is a model in which the environment, such as the evolution of investor preferences and the process of generating new information, combines to produce equilibria in return distributions [17]. Price changes are very random and unpredictable; the randomly evolving stock price would be the necessary consequence of intelligent investors competing to discover relevant information on which to buy or sell stocks before the rest of the market becomes aware of that information [12]. This suggests an efficient market, not an irrational one. Some scholars have shown that the movement of the composite stock price index in Indonesia was a random walk [24, 25]. If the stock price does not follow the time series model, the effect of relevant information, such as the FED rate and the price of crude oil, will be different for each stock or index and will be positive or negative.

Despite the importance of market information, empirical evidence suggests that stock prices in ASEAN markets are difficult to predict based on information from other markets [26]. Stock markets that do not consider the random walk process are highly volatile to economic crises [27]. The previous study found that the random walk hypothesis was rejected for the stock markets of Korea and Malaysia, Hong Kong, Singapore and Thailand for all different holding periods [28]. The recent study found that the financial crisis of the last 20 years, including the crisis due to the COVID-19 pandemic, showed signs of market inefficiency, which in turn has implications for abnormal profit opportunities. Thus, the random walk hypothesis needs to be more accepted in several stock markets in the G-20 members [29]. Other studies provide empirical evidence that in the Asian market the stock prices of the KSE 100 Index, the S&P BSE 500 Index, and the CSE All Share Index are not random walk processes and thus are hypothetically inefficient [30].

2.3 Prospect theory

Prospect theory modifies the analytic description of rational risk-averse investors found in standard financial theory. The Prospect theory is an alternative method of explaining choices made by individuals under conditions of risk or uncertainty [31]. Certainty contributes to risk aversion in choices involving certain gains and to risk seeking in choices involving certain losses. There are inconsistent preferences when the same choice is presented in different ways. The value function is typically concave for gains, typically convex for losses, and generally steeper than for gains. In this theory, a person's response to a loss is perceived to be greater than the response to a gain of the same nominal amount, and the implication is that there is an excessive response to risk, forming an attitude of loss aversion.

Prospect theory makes choices based on the effect of

outcomes on changes in their wealth; in other words, investors evaluate outcomes in terms of gains and losses relative to a reference point. Prospect theory is one of the theories that support the explanation that the stock return investors receive depends on the risk they may receive [32]. The risk-averse type is in the domain of gains, but the risk-seeking type is when all changes in wealth are perceived as a loss. Suppose investors have experienced that the results in the capital markets are good enough. In that case, they will go back after a shock or crisis because the losses in the past will soon be recoverable by future earnings. However, if they lose enough, they will be more cautious and bold to take risks. This theory suggests that investors will continue to make investments and make investment decisions based on the conditions that will date. Any stock shocks will soon be followed by recovery if there is still a good chance in the next period. Previous research revealed that stock returns are negatively associated with systematic risk over the COVID-19 pandemic at the Indonesia stock exchange [33]. According to the World Bank, the global economy still suffers from the effects of more than two years of the pandemic. In the post-COVID-19 era, the world economy will experience another major negative shock. Global growth is projected to slow from 5.7% in 2021 to 2.9% in 2022. This condition leads the investor to risk or uncertainty and pushes the investor to decide, such as risk aversion.

The previous study shows that a stock with a high (low) prospect theory value in its past return distribution earns a low (high) subsequent return in the Asian stock markets [34]. Another study found that the value of prospects theory has strong predictive power for stock market returns even during market turmoil due to regulatory changes in the stock market; this study also showed that investor inflows became larger after regulatory reforms [35].

Previous research provided strong evidence that the risk-return paradox exists in Indonesia, with firms performing below target being risk takers, while those above target levels are risk averse; these results claimed to support the basic propositions of prospect theory [36].

2.4 Hypothesis development

Previous research has found an impact of the economic crisis after COVID-19 on the capital market. For example, there are negative cumulative abnormal returns for the global stock market index, but with heterogeneous effects consistent with markets in more globalised economies being more vulnerable to international conflict [37]. Today's economies cannot stand alone; countries are interdependent and interrelated in providing food, energy and financing needs. Monetary policy in the United States, such as the increase or decrease in the FED rate, affects the availability of global investment funds. An increase in the FED rate in 2022 could trigger the flow of funds back to the United States; at the same time, it could also impact capital markets in other countries, including ASEAN countries [14].

The availability of energy, such as changes in the price of crude and palm oil, can also affect the global economy and investors' decisions. The price in the capital market is usually based on supply and demand. The investor's decision to bid determines the share price and then the return on the share. Investors' decisions can be influenced by various information, including changes in the global economy. In addition, the FED rate could act as global information and influence investors' decisions; the same situation is also changing crude oil and

crude palm oil prices on the ESG stock index or sustainability. Some scholars have found a positive influence of crude oil on the value of ESG family index stocks [38].

There was evidence that during the COVID-19 period, investors in Indonesia acted on the prospect theory because investors in Indonesia typically prefer to avoid risk and invest in low-risk investments [33]. ESG and sustainable finance companies are perceived to be low-risk, allowing for a shift in investment. Previous research has shown that investing in companies with ESG or sustainability impacts is low risk, but the risks identified are more related to climate change and environmental issues. There is limited investor awareness of sustainability and a desire to shift from typical investments to sustainability investments [39]. However, the investor's goal of making a profit must be addressed, which is why investors also consider the risk and return of companies in the sustainability category. The event study methodology analyses ESG ratings, CO₂ intensity and the influence of cumulative abnormal returns during the Russian invasion of Ukraine [40]. The study found that companies with high ecological scores positively influence abnormal returns in the pre-and post-event window.

Based on the Efficient Market Hypothesis, Random Walk Theory and Prospect Theory, as well as the discussion of previous research, it can be explained that when the price of crude oil rises, investors have valuable information that can lead them to shift their investments from sustainable stocks to crude oil investment instruments.

The crude oil commodity does have an unfavourable image when investing in the sustainable index [41]. Therefore, an increase in crude oil prices will lead to a decrease in the value of the sustainable index employed [42]. Crude oil volatility will cause shocks to global industries, including in Southeast Asia, which in turn will disrupt the economy [43]. Another study found a negative impact of oil on stock returns in ten emerging markets, including Indonesia [44].

It can be concluded that the increase in crude oil commodity prices allows changes in interest in investments in the stock market, including sustainable stocks. Investors will look for investments that are profitable as well as resistant to price shocks. Thus, the first hypothesis can be written as follows:

H1: There is a negative effect of crude oil price increase on sustainable index return.

Bank products (e.g. deposits) are a form of investment considered safe, although returns are low. The increase in the return on deposit investments will depend on the interest rate policy of the central bank (e.g. FED). Any policy of raising interest rates will lead to changes in investor behaviour [45]. Furthermore, if the FED decides to raise interest rates, it could increase the return on saving money in deposits. Hence, investors would likely shift their investments out of sustainable stock and into other products that benefit from the FED rate increase. Therefore, the second hypothesis can be written in the following way:

H2: There is a negative effect of the FED rate on sustainability index returns.

CPO price volatility can provide information on movements in the Malaysia industry growth [46]. The price interaction in the CPO market will make it easier for investors to shift their investments to other forms that are considered more profitable

[47]. This may include a change in investment in the sustainable index. If there is an increase in the price of both CPOs and crude oil, it can be assumed that the information will be used to shift sustainable stocks into CPO investment instruments, which are considered more profitable. Therefore, the third hypothesis can be written as follows:

H3: There is a negative effect of CPO on sustainability index returns.

3. METHODS

The research design of the study used a quantitative approach combining time series and cross-sectional data. The combination of time series and cross-sectional data provided more comprehensive and efficient information. Therefore, a regression data panel was used to analyse the data.

Of the eleven ASEAN countries, only six are members of the ASEAN Exchange. Of these six countries, only four countries have a sustainability index until 2022, namely Indonesia, Malaysia, Singapore and Thailand. Among the various sustainability indexes in these four countries, only the first existing index was selected, namely the FTSE4 Good Bursa Malaysia (F4GBM) index, the SRI-KEHATI index from Indonesia, the Singapore ESG Leaders Index (iEdge) and the Thailand Sustainability Investment (THSI).

The data was observed from 3 January to 30 June 2022, or six months, and included four indexes in four countries. Due to the difference in the number of holidays, the observed data faces unbalanced daily data. There were 118 daily data from F4GBM, 115 observed daily data from SRI-KEHATI, iEDge indices were 124 daily data and only 118 data from THSI. The unbalanced daily data did not cause any problems as long as the appropriate model was used, i.e. fixed and random effects. [48]. Thus, we could process the data with an unbalanced regression data panel. The total number of observations was 475 data sets.

The variables in the study were the Sustainable Return Index as the dependent variable crude oil, CPO and interest rates as independent variables. In this study, crude oil is a non-renewable energy proxy for West Texas Intermediate (WTI), and CPO is a renewable energy proxy for CIF Rotterdam. At the same time, the FED rate is used as a proxy for interest rates. WTI was chosen as a proxy because it is often used as the main reference in observing the world crude oil price. CIF Rotterdam was chosen because the CPO price already considers shipping and insurance costs, making the traded CPO price closer to the actual price. The FED rate is now the most influential banking rate in the world.

The research model to assess the impact of the global economic crisis on the Sustainable Stock Index is as follows:

$$Y = \alpha_{it} + \beta_1 Crude\ Oil_{it} + \beta_2 FED_{it} + \beta_3 CPO_{it} + \mu_{it}$$

Note: α_{it} : constant; $\beta_1 Crude\ Oil_{it}$: WTI; $\beta_2 FED_{it}$: FED rate; $\beta_3 CPO_{it}$: CIF Rotterdam; μ_{it} : standar error

Before the data can be further analysed to answer the hypothesis, it is necessary to test the appropriate model between the Common Effect Model (CEM) and the Fixed Asset Model (FAM). In this study, the Parm test is used to determine which model is selected. The parameters used are F-test and Breusch-Pagan.

Once the model has been determined, the next step is to assess the normality, multicollinearity and autocorrelation of

the data (see next section). Once all these steps have been taken, hypothesis testing can be carried out. Furthermore, in order to ensure that the results of the study are not different due to different situations or different conditions, the robustness test was conducted by splitting the data into Panel A for F4GBM Index and THSI and Panel B for SRI KEHATI and iEdge. The expected result showed the consistency of the research results before and after the robustness test (see next section). In this study, it is assumed that the significance levels of 1%, 5% or 10% are still considered acceptable values [49].

The data were processed using Stata 12 software based on the stages of data panel regression. Stata 12 provides a variety of statistical analysis methods ranging from descriptive statistics to regression and multivariate analysis techniques. This includes panel regression. Stata has the ability to handle specific problems that often arise in panel data analysis, such as heteroscedasticity, autocorrelation, and multicollinearity problems. Stata allows users to perform statistical tests of assumptions needed to validate panel regression models, such as heteroscedasticity tests (Breusch-Pagan test, White test), autocorrelation tests, collinearity tests, and others.

4. RESULT AND DISCUSSION

4.1 Descriptive statistics

The descriptive statistics in Table 1 explain the movements in crude oil, CPO prices and FED interest rates. The highest increase in crude oil prices was 8.35% in March 2022 compared to the last trading price. One of the main reasons for the increase was supply disruptions due to the conflict between Russia and Ukraine. The highest increase in CPO also occurred at the beginning of March 2022, when it rose by 12.38% compared to the previous trading day. Similar to the increase in crude oil, the main reason for the increase in CPO prices is supply and demand issues. In 2022, when business activities return to normal, and the demand for crude oil and CPO (e.g., used for B30 biodiesel) suddenly wakes up after sleeping for two years, it may force a demand and supply shock. Table 1 also shows the fluctuation rate of the FED rate. The highest increase occurred in June 2022; the FED rate increased to 1.58%. In response to the rising prices of various commodities and the deterioration of global economic indicators, one of the policies of the United States (US) government is to raise interest rates.

Table 1. Statistic descriptive

Variable	Mean	Minimum	Maximum	Std Dev
Return	-0.006	-5.79	2.39	0.848
Crude oil	0.267	-12.13	8.35	3.26
FED	0.407	0.08	1.58	0.417
CPO	0.175	-8.72	12.38	3.506

4.2 Determining the model and classical assumptions

The model used in the data analysis was tested using the Common Effect Model (CEM) and the Fixed Effect Model (FEM) using the parm-test with the F-test. The Breusch-Pagan test is then used to compare the feasibility of the model between CEM, FEM and Random Effect after the results of the comparison between CEM and FEM are known.

The measurement of a suitable model between the common effect model (CEM) and the fixed effect model (FEM) was

based on test parm. Firstly, on the F-test, it can be seen that the result of the F-test (3.468) produces an F-value of 0.350, with a P-value of 0.786 higher than 0.05. Therefore, the CEM model is more appropriate than the fixed effects model.

Secondly, the Breusch-Pagan test was used to measure the CEM and random effects models. The rule of thumb of the Breusch-Pagan test is to compare the P-value between the measurement models; if the P-value is low, the random effects model is more appropriate than the CEM. The result of the cross-sectional Breusch-Pagan value is 0.00 with a P-value of 1,000 higher than 0.05; it can be concluded that the CEM is more appropriate than the random effects model. Based on the test parm, the conclusion is that the CEM model was more appropriate to run the test.

Before running the data on a CEM model, we must examine its classical assumption. First, the normality test is based on the central limit theorem. The data distribution shows points close to a straight line, indicating that the data is normally distributed. Therefore, a normal p-plot graph was used, and the result data were considered to be normally distributed. Second, the result also does not take into account the issue of multicollinearity, as the variance inflation factor (VIF) value is 1.02 lower than the VIF rule of thumb $VIF < 10$. Third, the Wooldridge test used for autocorrelation in the data panel produced a P-value of 0.482, higher than the P-value of 0.05, so there is no autocorrelation problem. Fourth, based on the Breusch-Pagan or Cook-Weisberg test, no heteroscedasticity problem was indicated; the test produced a probability value of 0.8636, higher than 0.05.

4.3 The impact of crude oil, FED rate and CPO on return

After successfully determining the model and the classical assumption test, the CEM model was considered appropriate and free from classical assumptions. The results of the CEM model test are shown in Table 2.

Table 2. The CEM model test

Variable	Coef.	Std. Err.	t	P> t
_cons	.080	.055	1.470	0.142
Crudeoil	-.004	.012	-0.360	0.717
FED	-.211	.094	-2.250	0.025**
CPO	.001	.0112	0.120	0.905

Note: ***sig .001; **sig .005; *sig .010

Based on Table 2, it can be concluded that crude oil (t-value 1.470; P-value 0.142) and CPO (t-value -0.36, P-value 0.717) do not have a statistically significant impact on the sustainable return index, as the P-values of CPO and crude oil were above 0.10. The results of this study differ from previous studies [50, 51]. In this study, crude oil price and CPO fluctuations do not have a significant impact on the sustainable stock index return. The difference in the results of this study suggests that sustainable shareholders are more calm in the face of uncertain oil commodity prices.

Both crude oil and CPO are energy commodities with different characteristics. Crude oil is a limited resource that cannot be renewed. In contrast, CPO is one of the components of biodiesel, which can be considered an alternative energy and a renewable resource. The Sustainability Index measures the overall quality of a company's management in managing ESG issues. Companies included in the index tend to have a good ESG implementation rating. Therefore, companies listed in the Sustainability Index are companies that have excellent

management of resource and energy issues. As a result, the rise in CPO and crude oil commodities may not have a significant impact on the returns of the Sustainability Index [52].

As mentioned earlier, the EMH assumes that security prices reflect all information available to investors about the value of the security, which in turn could affect stock returns. The existence of investor awareness of sustainability may lead investors to react more calmly to price fluctuations in commodities such as CPO and crude oil. In other words, since the stocks in the sustainability index have met the ESG criteria, fluctuations in energy commodity prices will not impact the sustainability index. One of the ways to manage ESG issues is to innovate to reduce dependence on non-renewable energy and to start using renewable energy more often.

Table 2 also shows that the FED rate has a negative and statistically significant effect on the Sustainability Return Index as the P-value is less than 0.10. Based on various literature and research, monetary policies, such as the increase in the FED rate, usually affect investors' decisions. Based on prospect theory, individuals are under conditions of risk or uncertainty. Investors may become risk averse and consider choosing safe investments. An increase in the FED rate in the uncertain economic crisis after COVID-19 in 2022 could be a hedging decision for investors. The increased FED rate in uncertain conditions is a good choice for investors to divert their funds temporarily while waiting for normal conditions. This diversion of funds may lead to an increased decision to sell stocks, which may affect the composite stock price of the Sustainability Index. In turn, these conditions may affect the returns of the stocks included in the sustainability index. An interesting result of this study is that we can see government policy during the economic crisis in COVID-19 and post-COVID-19 conditions.

From the results reported in the previous paragraphs, it can be concluded that of the three variables or indicators, crude oil, CPO and the FED rate, only the FED rate has a significant negative effect on the Sustainability Return Index. When the FED rate is increased, it encourages investors to shift some or all of their investments from stocks in the sustainability index to banking products. The random walk theory explains that the stock price is not only based on the movement of historical data but is also influenced by current information. Stock prices can move randomly according to the conditions that affect them. One of the information investors pay attention to is the changes in the FED rate. In this study, the FED rate has been on an upward trend. As mentioned in the previous section, raising interest rates is one of the options chosen to deal with the economic crisis after COVID-19. Where these conditions differ from the policies adopted during COVID-19, many central banks reduced interest rates during COVID-19. Meanwhile, based on the trade-off theory, the principle of risk in the securities market is that low risk generates low return and vice versa. The FED rate fluctuation is an alternative for investors to hedge with higher returns with low risk compared to the returns of a sustainable stock index, which is also categorised as a low-risk investment.

Therefore, hypotheses 1 and 3 were rejected, or only hypothesis 2 was accepted. For additional information, this study also analysed the simultaneous analysis between crude oil, CPO and FED rate with return index. The results of the simultaneous tests in this study could be seen in the F-value. The F-value of this research produces a value of 1.740, and the P-value is 0.157, which is higher than 0.05. Crude oil, FED

rate and CPO cannot significantly affect the return of sustainability index stocks. Although in the explanation of Table 1, the highest increase of Crude oil and CPO occurred in March 2022, the highest FED Rate occurred in the next three months after the highest increase of Crude oil and CPO commodities. However, based on the result, the FED Rate affected the return of sustainability index stocks.

4.4 The robustness test

Sustainable finance, as an important factor in ASEAN's sustainable development agenda, can be seen in the ASEAN Taxonomy for Sustainable Finance. The achievement of the SDGs is also related to implementing sustainability principles in the private sector. The sustainability index in the capital market is one of the information for investors to make decisions. For companies listed in the sustainability index, this indicates that they have implemented sustainability principles in their business operations and have an environmentally responsible image.

As explained earlier, only four countries are included in the Sustainability Index: Indonesia, Malaysia, Thailand and Singapore. Therefore, the implementation of sustainability programmes in these four countries is examined. The high and low sustainability implementation of these four countries can be seen from the SDGs score.

The implementation of sustainability principles, as reported by companies, can improve the achievement of a country's SDGs. The achievement of a country's SDGs can provide investors with useful information for decision-making or validated information on implementing sustainability in the private sector. SDG ratings can influence investors to ignore or consider other information, such as changes in the global economy. Therefore, the influence of the variables in this study may have different effects on capital markets in countries with different SDG ratings. In this study of four countries, we consider the average SDG score and the information presented in Table 3.

Table 3. SDGs score 2021

Country	Rank 2021	Score 2022
	Panel A	
Thailand	43	74.19
Malaysia	65	70.88
	Panel B	
Singapura	76	69.89
Indonesia	97	66.34

Source: Sustainable Development Report 2021 [53]

We split the research object into two data panels to see if there is a difference in the impact of the global economic crisis in 2022 on data panels with different score ranges. Robustness checks split the data into Panel A for the F4GBM index (Malaysia) and THSI (Thailand). Panel B for SRI KEHATI (Indonesia) and iEdge (Singapore).

The Panel B data showed that Indonesia and Singapore had lower sustainability index scores than the Panel A data for Malaysia and Thailand. In other words, Malaysia and Thailand were perceived to be better at implementing the SDGs than Singapore and Indonesia. The implementation of sustainability in business should have a positive impact on the environment and enhance the achievement of sustainable development in a country.

Table 4. Common effect model panel A

Variable	Coef.	S.E	t	P> t
_cons	.084	.070	1.20	0.231
Crudeoil	-.015	.0154	-1.00	0.320
FED	-.209	.120	-1.75	0.082*
CPO	.007	.014	0.50	0.618

Note: ***sig .001; **sig. .005; *sig .010

The CEM results of the Panel A data model in Table 4 show a significant negative effect of the FED rate on index returns with a coefficient negative (0.209) and significant at the 10% level. Thus, this result was considered consistent with the hypothesis that the FED rate has a negative significant effect on sustainable stock returns. Meanwhile, the robustness test in Table 4 is also consistent with the hypothesis that CPO and crude oil have no significant effect on sustainable stock returns (see Table 2). In other words, the results are consistent between the hypothesis test and the robustness test.

Table 5 shows the results of the common effect panel data B, which are consistent with the hypothesis test. There were no significant effects of the two commodities, crude oil (coef. 0.011; sig. 0.546) and CPO (coef. -0.005; sig. 0.787) on the stock returns of the sustainability index, while the FED interest rate had a negative significant effect (coef. -0.298; sig. 0.040).

Panel B data is the group of sustainability index listed in Indonesia and Singapore with lower sustainability index scores than panel A data of Malaysia and Thailand (see Table 3). In other words, Malaysia and Thailand are perceived to have better implementation of SDGs than Singapore and Indonesia. The implementation of sustainability in business should have a positive impact on the environment and improve the achievement of sustainable development in a country. A lower level of coefficient and significance in Panel A data, with a higher SDGs score compared to Panel B, may indicate high investor awareness of sustainability. With such information, investors may feel reassured about global economic changes. Therefore, the results of the robustness test are consistent with the results of the hypothesis test. This consistency suggests that the ASEAN Sustainable Index could be resilient to the volatility of crude oil and CPO. However, the resilience is unstable under the influence of FED interest rate fluctuations during the economic crisis after COVID-19 in 2022.

Table 5. Common effect model panel B

Variable	Coef.	S.E	t	P> t
_cons	.157	.084	1.86	0.064
Crudeoil	.011	.018	0.61	0.546
FED	-.298	.144	-2.06	0.040**
CPO	-.005	.017	-0.27	0.787

Note: ***sig .001; **sig. .005; *sig .010

Furthermore, an F-test was conducted to test the simultaneous effect of crude oil, CPO and FED rate on sustainable stock returns. The result showed an F-statistic of 0.1786 with a significance level higher than 10%, indicating no simultaneous effect of volatile crude oil, CPO and FED rate on sustainable index returns. Based on the simultaneous test results, the sustainable index could be resilient to the simultaneous changes in the crude oil and CPO energy commodity indicators as well as the FED interest rate in the period after the economic crisis of COVID-19 in 2022. Thus, when investors were fully informed about the changes in crude

oil prices, CPO and the FED rate, their confidence in the return of sustainable stocks remained unchanged. Therefore, sustainability indices can increase resilience to changing global economic conditions, which are increasingly worrying due to climate change and limited energy sources.

The results of this study generally indicated that higher FED will reduce the return of sustainable stocks in the ASEAN market. Meanwhile, higher CPO and crude oil prices will not reduce stock returns. Thus, while investors' decisions will easily change based on market information related to the increase in interest rates, especially the FED rate, changes in investors' investment decisions will not easily change based on information related to the increase in crude oil and CPO prices. As a result, the ASEAN Sustainable Index could be resilient to crude oil and CPO volatility. However, the resilience is unstable under the influence of the FED interest rate in an economic crisis.

This finding generally applies to the sustainable finance market in 11 ASEAN countries, although it is only represented by Indonesia, Malaysia, Singapore and Thailand. This can be justified because only 4 of the 11 ASEAN countries trade in sustainable stocks.

5. CONCLUSION

As mentioned in the introduction section, this study examined the resilience of the stocks of companies listed in the ASEAN Sustainability Index. It was predicted that the volatility in the prices of CPO, crude oil and FED interest rates would affect the returns of the sustainability index. As is well known, the prices of energy commodities, crude oil and CPO rose sharply in the post-COVID-19 period after two years of price declines due to the COVID-19 pandemic. Russia's invasion of Ukraine exacerbated the increase in energy commodities.

Thus, the main contribution of this study is to examine the resilience of the stock value and stock returns of ASEAN sustainability index-listed companies.

The results generally contradict the research hypothesis. The results provide empirical evidence that CPO and Crude Oil did not significantly affect the stock returns of the stocks included in the sustainability index. These results indicate that despite the data showing an increase in CPO and Crude Oil prices in the post-COVID-19 period, the increase did not cause a change in stock returns. While the increase in the FED rate showed a decrease in the return of the sustainability index stocks, this can be interpreted that investors may change their investment decisions on bank products such as deposits.

The results of this study provide empirical evidence that sustainable stocks are relatively more resilient to crude oil and CPO than the increase in the FED rate during the economic crisis in the post-COVID-19 period. This study implies that the increase in the FED rate can attract investment in the sustainable stock market in ASEAN to the financial market in the US. When investing in bank products, investors can get the opportunity to earn a higher return with low risk due to the increase in the FED rate. Compared to investing in sustainable stocks, the risk is relatively low, but the return offered is relatively lower than investing in banking products supported by the FED rate increase. In addition, investing in bank products will not have a direct impact on sustainability issues.

The factor that can change investment preferences is the FED rate. The FED rate has a global influence that can

encourage other central banks, including those in ASEAN, to follow the FED's policy. This research found that any increase in the FED rate could cause investors to release their stocks in the sustainability index and reallocate their investments to banking products. The FED rate could make banking products (e.g. deposits) an attractive investment instrument due to their low risk but offer higher returns compared to the returns of sustainability stocks. Sustainability stocks are seen as a low-risk investment, although the return is also below expectations compared to bank products (e.g. deposits). The divestment of sustainability stocks and their placement in bank products is not only seen as more profitable but also as a way of mitigating the uncertainty of the global economic situation. In addition, there is no sign yet of the Russia-Ukraine conflict easing, leading to higher inflation due to the sharp rise in food, energy and other commodity prices. The FED is expected to continue to raise interest rates to counter inflation. However, the effect of the FED rate on the stock returns of the sustainability index may decrease if the country where the sustainability index stock market is located has a higher SDG score. Empirical evidence suggests a decrease in the effect of the FED rate in the data panel group with a higher SDGs score. SDGs are the achievement of a country's sustainable development, which requires the contribution of all economic sectors, including the private sector, in its achievement. The higher the SDGs score, the more significant the social impact of implementing sustainable finance.

CPOs and crude oil energy commodities appear to be less attractive, as even if the price rises, it will have a direct impact on environmental issues. Therefore, investors who are aware of sustainability issues will not choose to invest in crude oil and CPO but will still choose to invest in sustainable equities or shift their investments to bank products because they are considered relatively safe against the risk of loss and safe for the environment.

Crude oil is identical to the negative public perception of sustainability issues: the higher the demand for crude oil, the higher the oil price. The issue makes crude oil seem distant from sustainability principles. For this reason, it is possible that the higher price of crude oil is not enough to induce investors to reallocate their funds into crude oil investment instruments. The same has happened with CPO. Although CPO is one of the renewable energy products and can be a blend of diesel fuel, as Indonesia is doing with its bio-diesel, it is considered less attractive to investors, which cannot lead investors to release investments in sustainable stocks. Furthermore, there is not enough evidence to suggest that using CPO can make production and manufacturing processes more environmentally friendly. However, if strong evidence is found that CPO can make production and manufacturing processes more environmentally friendly, CPO could become an environmentally friendly investment.

Investors are convinced that the companies listed in the sustainability index tend to be companies that have successfully implemented ESG principles. The companies that implemented ESG principles were those whose production and operational processes were supported by research and development in technology and renewable energy. Today, it is undeniable that dependence on fossil fuels is still relatively high, but optimism about the presence of renewable energy is also growing. Today, the market is more optimistic about the development of renewable energy, and this optimism may not encourage investors to easily switch their investments from sustainable stocks to crude oil and CPO. Crude oil and CPO

can be seen as unprofitable long-term investments. Investors in sustainability stocks tend to be sensitive to sustainability issues, tend to invest in renewable energy companies, and do not tend to shift investments into crude oil or CPO despite the high prices of these commodities.

In 2020-2022, the world experienced two economic crises. In 2020-2021, the world was challenged by the COVID-19 pandemic, which triggered an economic crisis. During the COVID-19 pandemic, the physical distancing policy and the prohibition of crowds caused various industries to shut down. The economy seemed to collapse as a result. This led to a significant reduction in fuel consumption, and, not surprisingly, the price of crude oil and CPO (a fuel additive) fell (see previous section). To prevent the economy from falling further, central banks such as the FED then reduced interest rates.

Conversely, in 2022, when the COVID-19 pandemic began to recover, the world experienced a post-COVID-19 economic crisis. As the industry began to recover, crude oil and CPO prices rose again compared to the COVID-19 period due to increased demand. This situation was exacerbated by the conflict between Russia and Ukraine, which led to an increase in the cost of living, including fuel prices. Interest rates, which had been lowered during the COVID-19 period, were raised during the post-COVID-19 period in order to maintain economic stability and attract funds to the US. It is well known that the FED central bank has a significant influence on the world economy.

ASEAN countries are considered developing, making the ASEAN market an emerging market. Due to their dependence on developed countries, ASEAN countries are the most likely to be economically affected by an economic crisis. Therefore, the issue of ASEAN's resilience to economic crisis is an interesting one. Similarly, the discussion on sustainable finance in ASEAN is related to the resilience of sustainability index-listed stocks in ASEAN countries such as Indonesia, Singapore, Thailand and Malaysia.

The implications of this research can be seen from several viewpoints for investors, such as companies, governments and the general public. As owners of funds, they expect their investments to generate returns (e.g. stock returns). Based on this research, investing in sustainable index shares may have a lower return than investing in banks. However, it has the advantage of being more resilient in times of crisis. In the future, investing in sustainable companies will become an obligation, in line with government regulations related to implementing sustainable finance. For companies, the existence of a sustainable index can be a source of funding to improve product innovation and ESG-based business operations. For governments, the results of this study emphasise the importance of private and corporate contributions to the achievement of the SDGs, and vice versa. The SDGs have a positive impact on investments, companies and society. The implementation of sustainable finance in the private sector will have an impact on improving the SDGs and quality of life, as well as driving innovation in greener products and services. For policymakers, especially those in ASEAN countries, the study's findings can provide valuable information to design policies that can strengthen macroeconomic factors to keep inflation under control without the need for excessive central bank intervention by raising interest rates. Although raising interest rates can control inflation and increase the currency's value, high-interest rates can eventually lead to higher interest rates on loans and, in the

future, reduce investment other than investment in banking products. In addition, the implementation of sustainability should be a concern of the government so that environmental sustainability continues, which will have a positive impact on corporate sustainability.

This study focuses only on crisis indicators related to energy commodities, such as crude oil prices as a proxy for non-renewable energy, CPO as a proxy for renewable energy and the FED rate as a monetary proxy. This focus is one of the limitations of this study, as other macroeconomic indicators such as inflation, GDP and poverty should be discussed and are considered to be other important indicators to examine resilience issues. In other words, crude oil prices, CPO and FED interest rates may not be sufficient to describe the dynamics of changes in investor behaviour towards stock returns in the sustainable stock market and sustainability issues in general. However, as explained earlier, based on the post-COVID-19 period, energy commodities and FED interest rates are indicators that have increased significantly compared to the pre-COVID-19 period. Hence, the use of these indicators seems more appropriate to study first. Future research needs to examine more comprehensive macroeconomic factors such as GDP, inflation and poverty to predict the resilience of financial markets to economic crises.

Another limitation of this study is that it only used daily data in the post-COVID-19 period in the first six months of 2022, so it cannot describe the entire crisis period that lasted until this study was completed. Next, the one-year period 2022 needs to be re-examined to get a more complete description of the 2022 period. For this reason, the 2021 SDGs score data was chosen as the basis for determining panel data A and B. In the 2022 SDGs score report, there is a change where Singapore's SDGs score is higher than Malaysia's [54].

In addition, this study does not make empirical comparisons with previous crisis periods, such as the COVID-19 period and other economic crises. Therefore, this study could not fully explain the sustainability resilience of the stock performance of companies listed in the sustainability index. In the future, it would be better to examine resilience by comparing it with several crisis periods.

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