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The Impact of Macroeconomic Variables Shocks on Sustainable and Islamic Indices in Indonesia (2016-2023)

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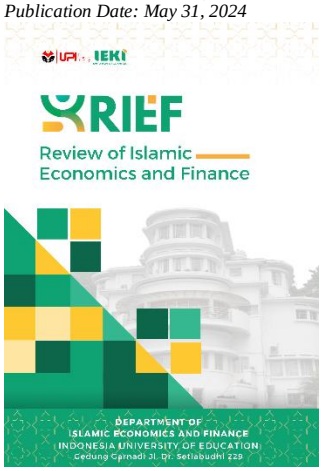

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Abstract

Purpose *– This study aims to analyze the influence of shocks in macroeconomic variables on the Sharia index and sustainable index represented by ISSI and JII as the Sharia index and SKEHATI as the sustainable index on the Indonesia Stock Exchange. By studying the impact of macroeconomic shocks on the aforementioned indices, it is expected to provide guidance for investors and stakeholders in making investment decisions and taking appropriate precautions in fluctuating market conditions.*

Methodology *– Descriptive quantitative analysis with VAR/VECM analysis to examine the shocks of macroeconomic factors to the three indices. Co-integration analysis and Granger Causality Test are also used to examine the correlations between variables. The data used consists of the data from the last 7 years from Bloomberg's terminal.*

Findings *– From this study, it was found that JII can respond to macroeconomic shocks more quickly compared to ISSI and SKEHATI. SKEHATI is the dominant factor influencing the Sharia index, including ISSI and JII.*

Keywords: *Islamic index, macroeconomic shocks, sustainable index, VAR/VECM*

1. INTRODUCTION

The capital market plays an important role in the economic growth of Indonesia as one of the financial instruments (Mahri et al., 2022). The capital market is also one of the sources of financing in business. Several studies have examined the positive impact of the capital market on economic growth, including Adam (2015), Handriani & Robiyanto (2018), and also Hismendi et al. (2021). The development in the financial sector, especially the capital market, is expected to contribute to long-term economic stability, as researched by Kapaya (2020); Darmawan (2022).

In Indonesia, there are currently 41 indices listed on the Indonesia Stock Exchange (IDX), including the Composite Stock Price Index (CSPI or IHSG), launched in 1983, LQ45 (1997), and the Jakarta Islamic Index (JII), launched in 2000, followed by other indices. In 2009, the Sustainable Responsible Investment-KEHATI (SRI-KEHATI) was launched as a result of collaboration between the Indonesian Biodiversity Foundation (KEHATI) and IDX. In 2011, the Indonesia Sharia Stock Index (ISSI) was launched, which, like JII, is evaluated every six months to determine compliance with the criteria and regulations, thus enabling classification in the Sharia Issuers List (IDX ISLAMIC, 2022).

Previous studies, Jawadi et al. (2014) conducted a study comparing the performance of conventional indices with ethical indices (sharia or sustainable), concluding that these indices are strongly influenced by volatility or uncertainty, besides that it is seen that these indices influence each other and the response to shocks also varies. while Suryadi et al. (2021), who analysed the risks and returns between conventional and sharia indices, concluded that the performance of the sharia index was worse than the conventional index during the period January 2017 to July 2019. To the best of our knowledge, there are few studies that conduct comparative studies between Islamic and sustainable indices based on their response to macroeconomic shocks in a fairly long period of time where in that period there were several crises, where the crisis due to the Covid-19 pandemic was the largest global crisis on the last decade.

This research focuses solely on assessing the performance of three indices: sustainable stocks, represented by SKEHATI, and Sharia stocks represented by ISSI and JII. These three are the dominant sustainable or Sharia stock indices in the Indonesian capital market and can be analysed over a certain period where various crisis (May 2016 to March 2023), have caused macroeconomic shocks resulting in market volatility. This study can contributes to the researches that answers how macroeconomics shocks affect the sharia and sustainable indices and how those indices respond the uncertainty.

2. LITERATURE REVIEW

The study conducted by Rehman & Karimullah (2023) examined the impact of financial crises and the COVID-19 pandemic on the stock markets of six Gulf countries (Gulf Cooperation Council/GCC), concluding that the financial crisis (2007–2008) had a negative impact on four out of the six observed stock markets, while the pandemic crisis did not significantly affect the overall stock markets and even had a significantly positive impact on the stock markets of two countries (the United Arab Emirates and Saudi Arabia). Meanwhile, other research on the volatility and correlation of Sharia stock markets in several countries around the world (Abdullahi, 2021) showed that the pattern of volatility transmission in Sharia stock markets had the same response as found in conventional indices during the COVID-19 crisis. This could be due to the fact that the COVID-19 crisis is different from the previous crisis in 2008/2009, which only affected the financial sector.

There have been many studies analysing the relationship between macroeconomic factors and the capital market over the past few decades, including Mukherjee & Naka (1995), who concluded that there is a long-term equilibrium relationship between a group of macroeconomic variables and indices on the Bombay Stock Exchange. The analysis also showed that industrial production is the largest positive determinant in the Indian stock index price, while the largest negative determinant is inflation. The five observed macroeconomic variables also showed co-integration. Meanwhile, Gay, Jr. (2008), who specifically studied the effect of macroeconomic variables on capital market returns, especially in four countries, namely Brazil, Russia, India, and China (BRICS), concluded that there is no significant relationship between exchange rates or oil prices and stock market index prices in these four countries. Another conclusion drawn is that the market efficiency of BRICS countries is weak, where current and past market returns do not have a significant relationship. Inflation and stock returns in India and China show a significant positive relationship but show a negative relationship in the stock markets of Russia and Brazil (Tripathi & Kumar, 2014). Furthermore, there is no long-term co-integration relationship between stock index values and inflation values. Nurrachmi (2018) specifically studied the movement of Sharia stock indices in several Organization of Islamic Cooperation (OIC) countries during the crisis period and after the crisis, concluding that there is co-integration in Sharia stock markets after the economic crisis but not during the crisis. Investors can benefit from portfolio diversification in these six OIC countries in the long term.

A specific study on the relationship between economic crises, macroeconomic variables, and stock prices was also conducted by Madurapperuma (2023), concluding that in the long term, macroeconomic variables and stock prices have a significant dynamic relationship, while economic crises significantly affect stock prices in the short term. The macroeconomic variables used in this study include:

1. Gross domestic product (GDP), an important indicator in the economy, reflects a country's ability to generate value-added or output from each sector or business field. Pilinkus & Boguslauskas (2009) explain the positive impact of GDP and money supply on stock market prices, while unemployment rates, exchange rates, and interest rates negatively affect stock market prices.
2. The exchange rate of USD to IDR (KURS) represents the exchange rate of the Indonesian Rupiah against the US Dollar, describing the value consumers must pay for imported goods, including tariffs and transaction costs for importing goods. This exchange rate is related to exports and imports, reflects the value of the Rupiah against foreign currencies, and indicates a country's position in global trade competition, thus correlating positively with real economic activity (Permana et al., 2023).
3. Inflation (INFLASI) reflects the overall price increase usually represented by the consumer price index for the movement of goods and services prices. High inflation rates indicate a greater need to buy the same goods (Putra et al., 2023). Geetha et al. (2011) propose a long-term relationship between inflation and stock returns, but short-term relationships do not occur in Malaysian and US markets. Short-term relationships between these variables occur in the Chinese market.
4. The Bank Indonesia Interest Rate (BIRATE), set every 7 days, is the interest rate determined by BI. This interest rate reflects the government's policy through BI in determining the benchmark interest rate announced to the public periodically. The implementation of this BI rate is in financial operations, especially in liquidity management in the money market, to achieve the operational targets of monetary policy. Kaluge (2019) found that the BI rate, as

one of the macroeconomic policy factors, affects equity markets and sectoral conditions in the financial markets. Based on this study, macroeconomic components (BI rate, inflation, and exchange rate) have a negative effect on various industries such as chemicals, consumer goods, infrastructure, mining, property, trade, engineering, etc. While real macroeconomic factors such as foreign exchange reserves, export values, and Indonesian crude oil prices will have a negative impact on the mining industry.

3. METHODOLOGY

The model used in this study is the Vector Error Correction Model (VECM), and the data processing tool used is the Eviews 9 program. This modelling aims to understand or obtain an overview of the interaction between the Sharia Stock Index and the Sustainable Stock Index, Gross Domestic Product (GDP), exchange rates, inflation, and interest rates in Indonesia. Below is the process of forming the VAR/VECM model:

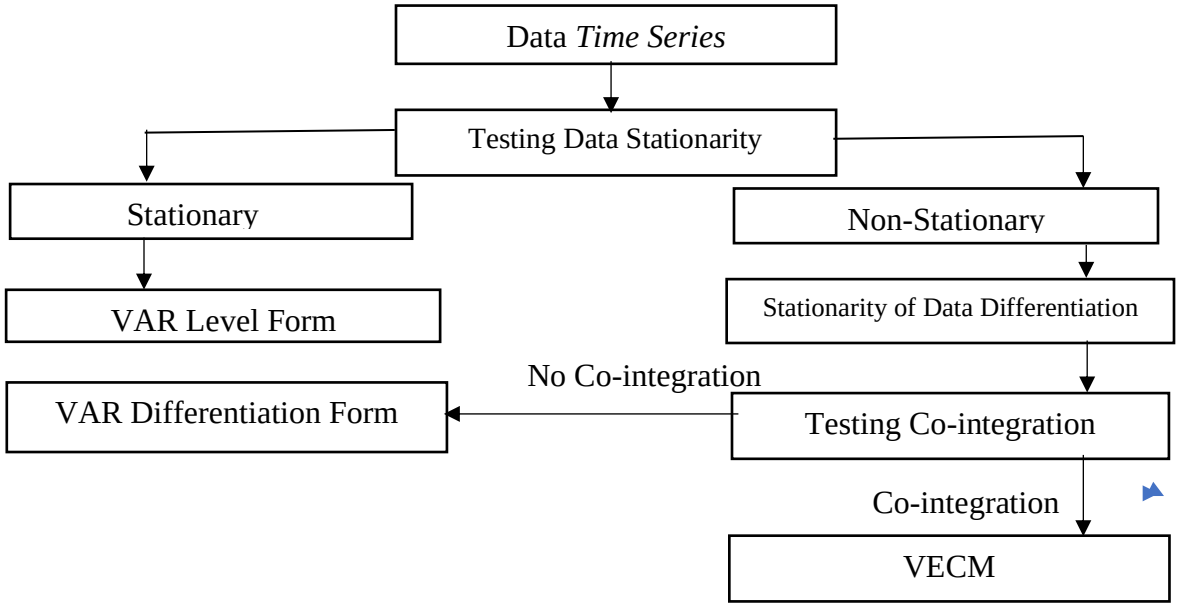

Figure 1. Process of VAR/VECM Model Formation
Source: Ekananda, 2016

The Vector Error Correction Model (VECM) was developed from Vector Auto-regression to analyze the behavior of non-stationary data more deeply (Ekananda, 2016). In VECM, unlike VAR, all variables must be different in the first order or must have the same stationarity. This analysis also considers the presence of data fluctuations moving around long-term trends, which can be used to analyze corrections in dependent variables due to imbalances in some variables. The VECM model is used in non-structural VAR models when time series are non-stationary at the level, but stationary in differentiated data and co-integrated, indicating a theoretical relationship between variables (Widarjono, 2013).
The general formulation of the VECM model can be expressed as follows:

$$\Delta yt = \mu 0x + \mu 1xt + \pi xy_{t-1} + \sum_{i=1}^{p-1} rix\Delta y_{t-1}\varepsilon t$$

Where:
yt = vector containing the variables analyzed in the study
μ0x = intercept vector
μ1x = regression coefficient vector
t = time trend
πx = αx βy where b contains the long-term co-integration equation
yt-1 = variable in-level
rix = regression coefficient matrix
p-1 = order of VECM from VAR
εt = error term

thus:

$$ISSI_t = a_1 + \sum_{i=1}^{P} b_{1i} ISSI_{t-i} + \sum_{i=1}^{P} c_{1i} JII_{t-i} + \sum_{i=1}^{P} d_{1i} SKEHATI_{t-i} + \sum_{i=1}^{P} e_{1i} GDP_{t-i} + \sum_{i=1}^{P} f_{1i} KURS_{t-i} + \sum_{i=1}^{P} g_{1i} INFLASI_{t-i} + \sum_{i=1}^{P} h_{1i} BIRATE_{t-i} + u_{1t}$$

$$JII_t = a_2 + \sum_{i=1}^{P} b_{2i} ISSI_{t-i} + \sum_{i=1}^{P} c_{2i} JII_{t-i} + \sum_{i=1}^{P} d_{2i} SKEHATI_{t-i} + \sum_{i=1}^{P} e_{2i} GDP_{t-i} + \sum_{i=1}^{P} f_{2i} KURS_{t-i} + \sum_{i=1}^{P} g_{2i} INFLASI_{t-i} + \sum_{i=1}^{P} h_{2i} BIRATE_{t-i} + u_{2t}$$

$$SKEHATI_t = a_3 + \sum_{i=1}^{P} b_{3i} ISSI_{t-i} + \sum_{i=1}^{P} c_{3i} JII_{t-i} + \sum_{i=1}^{P} d_{3i} SKEHATI_{t-i} + \sum_{i=1}^{P} e_{3i} GDP_{t-i} + \sum_{i=1}^{P} f_{3i} KURS_{t-i} + \sum_{i=1}^{P} g_{3i} INFLASI_{t-i} + \sum_{i=1}^{P} h_{3i} BIRATE_{t-i} + u_{3t}$$

The followings are the steps of VAR/VECM Model Analysis:

1. Testing data stationarity using the unit root test or the Augmented Dickey-Fuller (ADF) test (Widarjono, 2013).
   H_0: Stationary
   H_1: Non-stationary
2. Testing Optimal Lag Length, which can be determined based on criteria such as Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), or Hannan Quinn (HC).
3. Test the Co-integration to determine the long-term relationship between variables, using the Johansen Co-integration Test, which is a specific test for VAR models with differentiated data (Ekananda, 2016).
   H_0: No co-integration relationship
   H_1: Co-integration relationship exists
4. Conduct the Granger Causality test to find the two-way causality relationship between endogenous variables in the VAR system.
5. Estimate the VECM using Impulse Response Function Analysis and Variance Decomposition Analysis.
   a. Impulse Response Function Analysis:
      In IRF analysis, we can measure the impact or influence of one endogenous variable on another in the VAR system. IRF can also be used to identify the sequence of variable processes established in theory and previous empirical research. By using IRF, we can confirm whether the transmission or sequence of variable processes can be supported by the estimated VECM (Widarjono, 2013).
   b. Variance Decomposition Analysis
      Variance Decomposition (VD) is another analysis method that can be used to depict the dynamic VAR (Vector Auto-regression) system, different from Impulse Response Function (IRF) analysis. VD can provide information about the relative or significant

contributions of each variable in the VAR system to its variance due to shocks or changes in specific variables in the VAR system.

4. RESULTS AND DISCUSSION

In analysing the influence of shocks in macroeconomic variables, namely the interest rate (BIRATE), exchange rate (KURS), Gross Domestic Product (GDP), and inflation rate (INFLASI) on the movement of the three indices, the VAR/VECM Model is used as follows:

1. Stationarity Testing

   The initial step of this testing involves conducting a unit root test on all variables of the data, resulting in the following table:

Table 1. Unit Root Test

Variable	**Critical Value (α)**	***Level***		***First Difference***	
		t-stat	***p-value***	***t-stat***	***p-value***
SKEHATI	5%	-2.430055	0.1342	-20.46951	0.0000
ISSI	5%	-2.041669	0.2690	-19.98923	0.0000
JII	5%	-1.902708	0.3310	-21.8534	0.0000
BIRATE	5%	-1.707876	0.4264	-4.718516	0.0001
KURS	5%	-2.816386	0.0569	-20.72942	0.0000
GDP	5%	-2.340383	0.1599	-21.00298	0.0000
INFLASI	5%	-0.380716	0.9094	-18.97029	0.0000

   In the table above, it is observed that the data at the level are all non-stationary because the p-values are greater than the critical values of 1%, 5%, and 10%. Thus, differencing is performed to make the data stationary. Subsequently, unit root testing is conducted on the first difference, and p-values are obtained which are less than the critical values of 1%, 5%, and 10%. This demonstrates that in the first differencing result, there are no longer any unit roots present, or the data has become stationary, enabling the model identification process.

2. Optimal Lag Length Testing

   The determination of the optimal lag length is based on the values of the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC). According to the AIC criterion, the suggested optimal lag is 3 (the smallest AIC value), while the SIC criterion suggests the optimal lag at lag 2 (the smallest SIC value). Therefore, the best VECM model can be conducted from lag 1 to lag 3. Consequently, the smallest optimal lag, which is 2, is selected.

Table 2. Optimal Lag Testing

Lag	Log L	LR	FPE	AIC	SC	HQ
0	3372.314	NA	1.38e-17	-18.95951	-18.88316	-18.92914
1	6919.246	6934.004	3.80e-26	-38.66618	-38.05536	-38.42318
2	7120.385	385.2797	1.61e-26	-39.52330	-38.37802*	-39.06768*
3	7178.578	109.1725	1.53e-26*	-39.57509*	-37.89535	-38.90684
4	7212.278	61.89455	1.67e-26	-39.48889	-37.27469	-38.60802
5	7258.792	83.59409	1.70e-26	-39.47488	-36.72623	-38.38140
6	7305.025	81.26548	1.74e-26	-39.45929	-36.17617	-38.15318
7	7344.475	67.78822*	1.84e-26	-39.40549	-35.58791	-37.88676
8	7378.209	56.63443	2.02e-26	-39.31949	-34.96744	-37.58813

3. Determining Co-integration

In Annex 4, the co-integration test results for lag 1 show that the trace statistic and maximum Eigen-value at r=1 are larger than the critical value at a significance level of 5%. This means that the null hypothesis stating that there is no co-integration is rejected, and the alternative hypothesis stating that there is co-integration cannot be rejected. Therefore, it can be seen that among the six variables in this study, there will be at least one co-integration at the 5% significance level.

Thus, the results of this co-integration test indicate the presence of stability/equilibrium and similarity of movements in the long term or in each short-term period. All variables tend to adjust to achieve their long-term equilibrium. Based on these results, the estimation of the VECM equations can be conducted.

From the long-term co-integration test results, generally co-integration occurs among variables as indicated by the calculated T value > T table (1.9666), except for BIRATE where no co-integration occurs. In the short-term co-integration test, co-integration among variables occurs, which can be summarized in the following table:

Tabel 3. Short Term Co-integration Test

t-1	t-2	t-3
SKEHATI/BIRATE	SKEHATI/GDP	SKEHATI/KURS
SKEHATI/GDP	JII/BIRATE	JII/BIRATE
JII/JII	ISSI/GDP	

4. Stability Testing of VAR/VECM

Table 4. Stability Testing of VAR/VECM

Root	***Modulus***
0.994325	0.994325
0.992042 - 0.018173i	0.992208
0.992042 + 0.018173i	0.992208
0.969861	0.969861
0.932116	0.932116
0.887694	0.887694
0.771062	0.771062
-0.432759	0.432759
-0.327460	0.327460
-0.141613 - 0.222402i	0.263661
-0.141613 + 0.222402i	0.263661
-0.028429 - 0.077871i	0.082898
-0.028429 + 0.077871i	0.082898
-0.021719	0.021719
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

The table above indicates that all modulus values are less than 1, indicating that the VAR/VECM model is in a stable condition.

5. Granger Causality Test Results

Table 5. Granger Causality Test

	SKEHATI	ISSI	JII	BIRATE	KURS	GDP	INFLASI
SKEHATI			→	→	↔	→	
ISSI	→		→	→	→	→	→
JII					→	→	
BIRATE							
KURS				→		↔	
GDP				→			→
INFLASI				↔			

Granger Causality Test Results in Table 15 above show a two-way relationship between SKEHATI and KURS, KURS and GDP, and INFLASI and BIRATE. This indicates that the VECM model is appropriate for depicting the relationship behavior among variables. SKEHATI has a one-way relationship with JII, BIRATE, and GDP, while ISSI has a one-way relationship with SKEHATI, JII, BIRATE, KURS, GDP, and INFLASI. JII only has a one-way relationship with KURS and GDP. Meanwhile, the macroeconomic factors, namely KURS, have a one-way relationship with BIRATE, and GDP has a one-way relationship with BIRATE and INFLASI.

6. Best VECM Model

The most optimal VECM model is the lag 2 VECM model, as indicated by the results of the optimal lag testing in Table 2 above. Here are the results of the Impulse Response Function (IRF) analysis and Variance Decomposition analysis of the impact of shocks in macroeconomic factors on the three indices:

4.1 JII's Response

Below is a graphical representation of the Impulse Response Function (IRF) analysis, providing a visual insight into the response of each variable over the next 100 periods to a shock of 1 (one) standard deviation. The response of the JII index to shocks from the other six variables fluctuates until the third period, then stabilizes relatively by the fifth period, especially in response to shocks from SKEHATI, BIRATE, and ISSI. In response to shocks in GDP, INFLASI, and KURS, the JII response appears to stabilize faster compared to other variables, around the third period. Meanwhile, the peak response to shocks occurs at different periods for each variable. SKEHATI, ISSI, and BIRATE have a negative relationship with JII, while GDP, KURS, and INFLASI have a positive effect on JII.

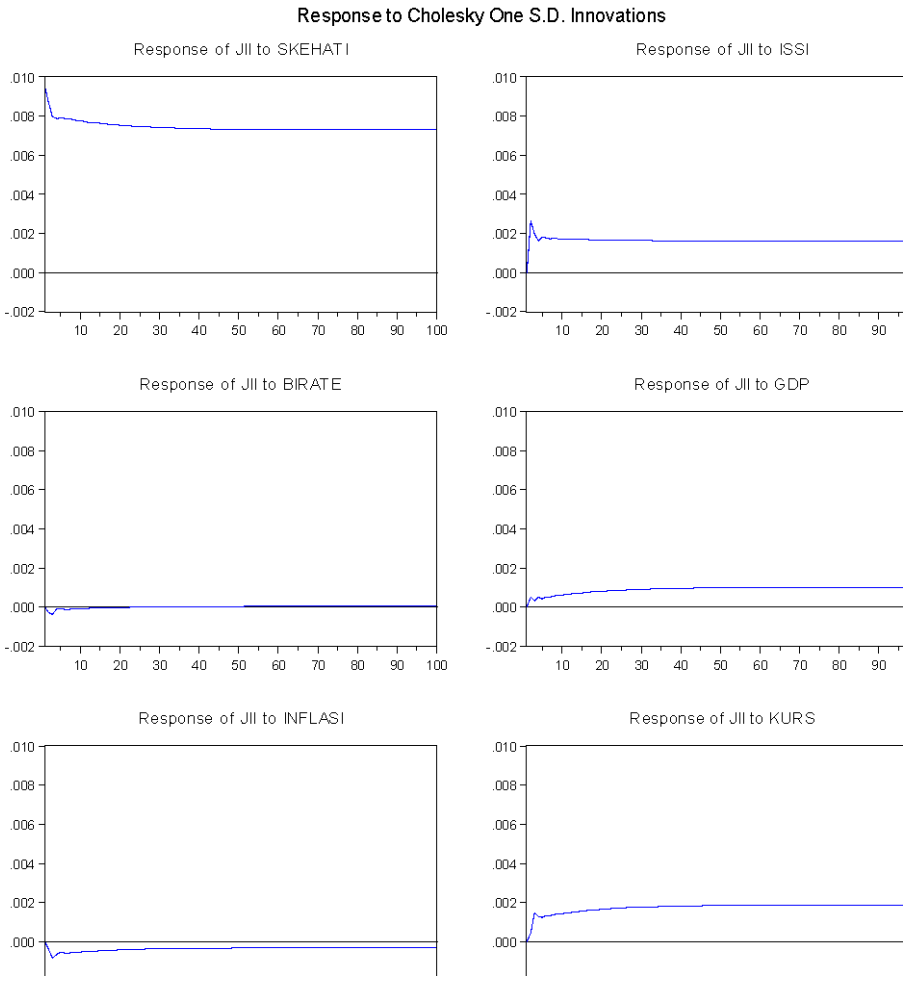

Figure 2. IRF Graph's response to JII

4.2 ISSI's Response

In the graph below, we can see the response of ISSI to shocks from other variables over 100 periods, where fluctuations generally occur in the first 3 periods. Only SKEHATI appears to provide shocks up to the 5th period. Subsequently, almost all variables stabilize from the 5th period to the 100th period. The peak fluctuation in response to shocks occurs in the first 3 periods. SKEHATI, ISSI, BIRATE, and GDP have a negative relationship with ISSI, while INFLASI and KURS have a positive relationship with ISSI.

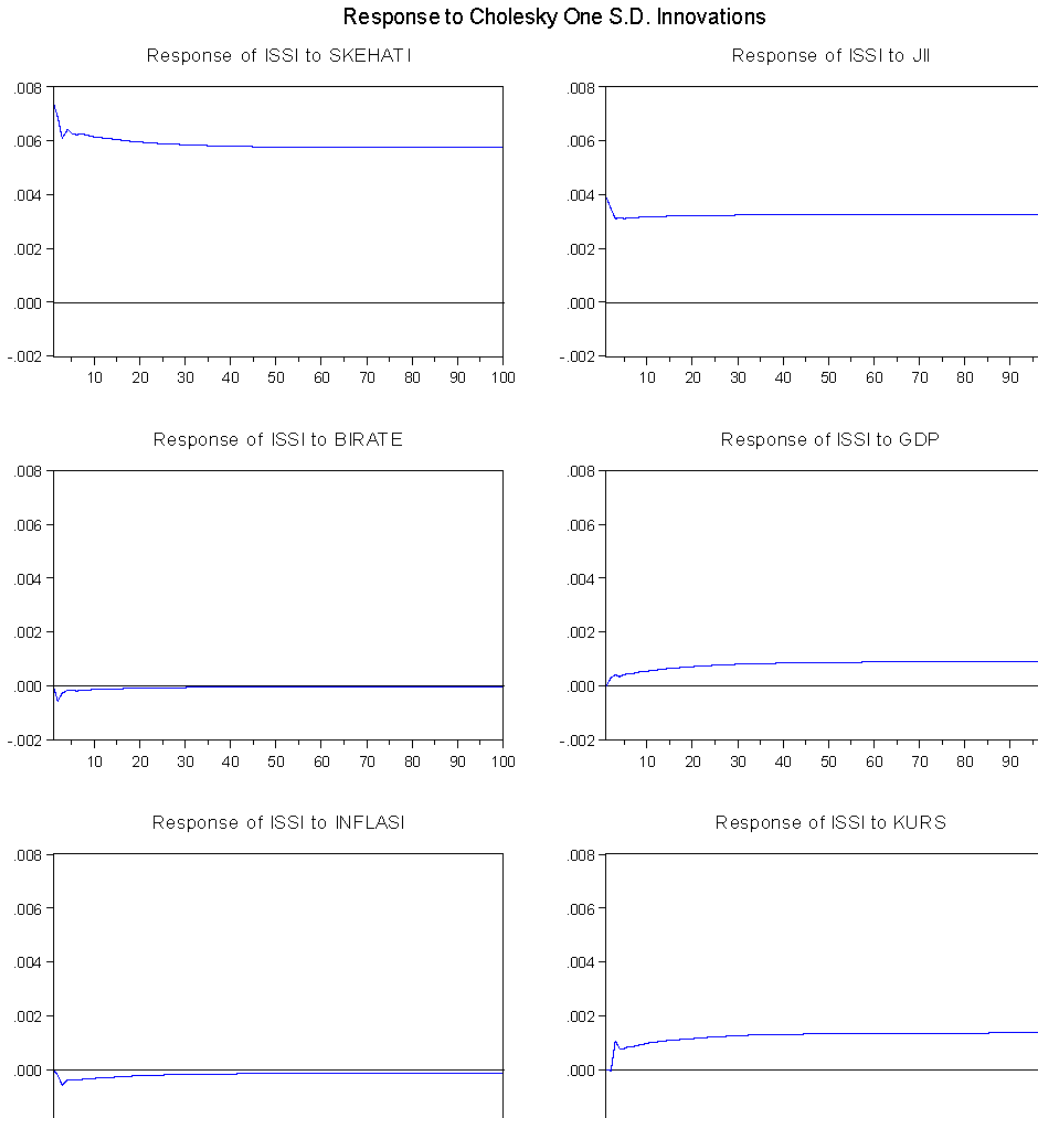

Figure 3 IRF Graph's Response to ISSI

4.3 SKEHATI's Response

The graph below illustrates the shocks from the other 6 variables to SKEHATI, where these shocks primarily occur in the first 5 periods, then gradually decrease or depreciate until stabilizing around the 7th period in response to JII, ISSI, BIRATE, and GDP. Meanwhile, towards the other three variables, namely INFLASI and KURS, SKEHATI shows an increasing response before tending to stabilize around the 5th period.

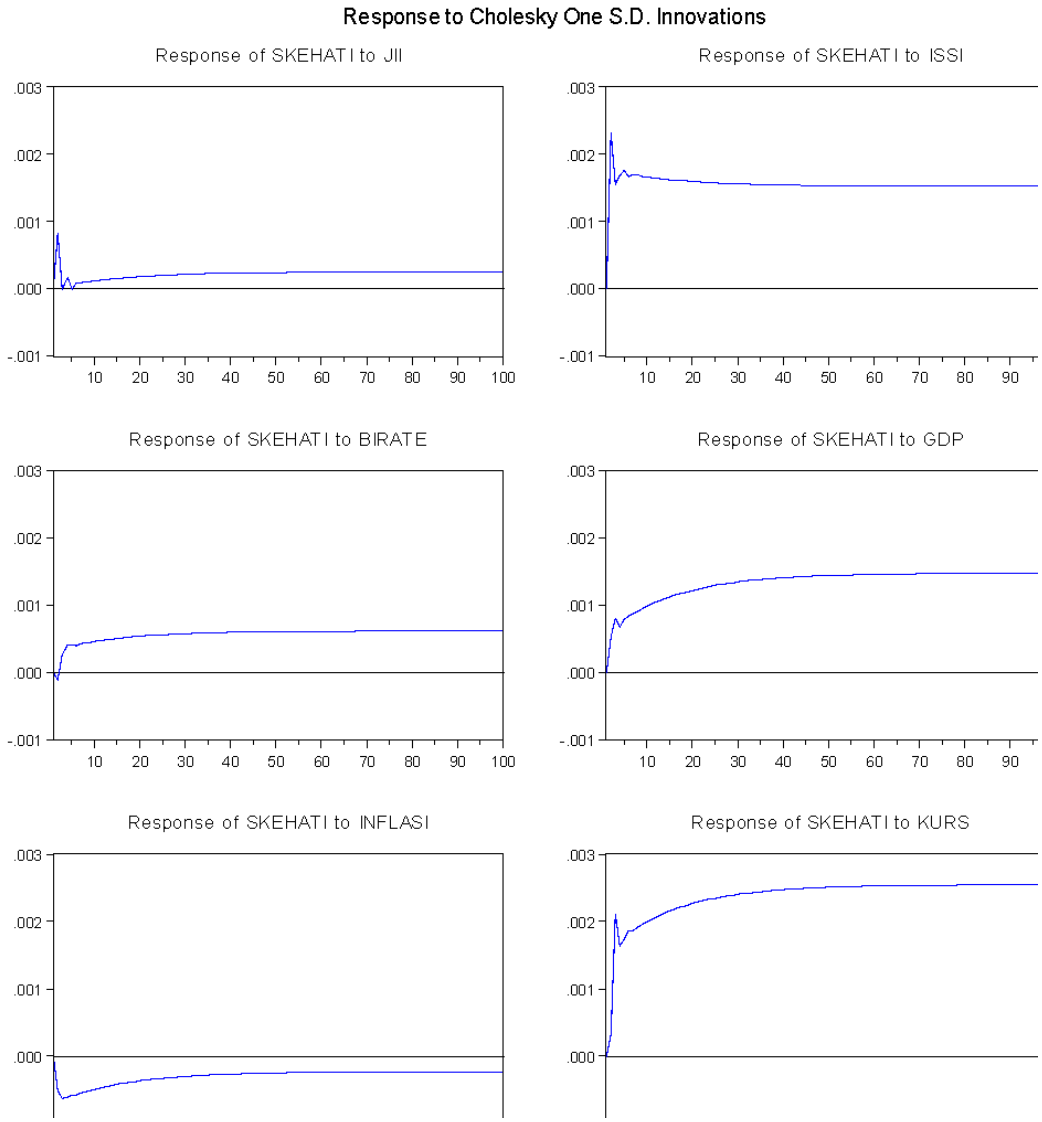

Figure 4 IFR Graph's Response to SKEHATI

Forecast Error Variance Decomposition

The graph below represents the Forecast Error Variance Decomposition, which describes the influence of the three indices, namely JII, ISSI, and SKEHATI, as well as the influence of macroeconomic factors on them:

The FEVD (Forecast Error Variance Decomposition) graph for JII indicates that the dominant factor influencing JII is SKEHATI, followed by JII itself, with the third dominant factor being KURS. This is because JII is predominantly composed of issuers operating in industries influenced or related to KURS or foreign exchange. Meanwhile, ISSI, BIRATE, and GDP do not significantly influence JII.

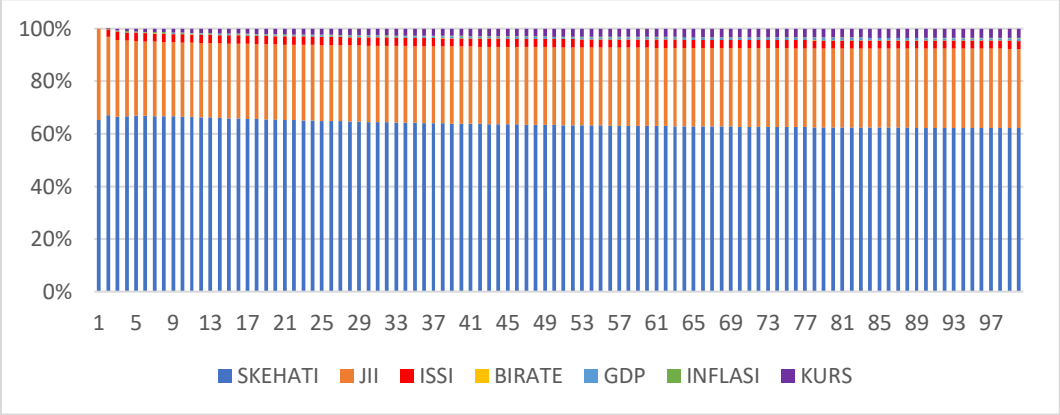

Figure 5 FEVD JII Graphic

In the FEVD graph for ISSI below, it is evident that ISSI is heavily influenced by the SKEHATI index, followed by ISSI itself. The third dominant factor influencing ISSI is JII, followed by KURS. Meanwhile, the two other variables, GDP and INFLASI, have minor effects on ISSI.

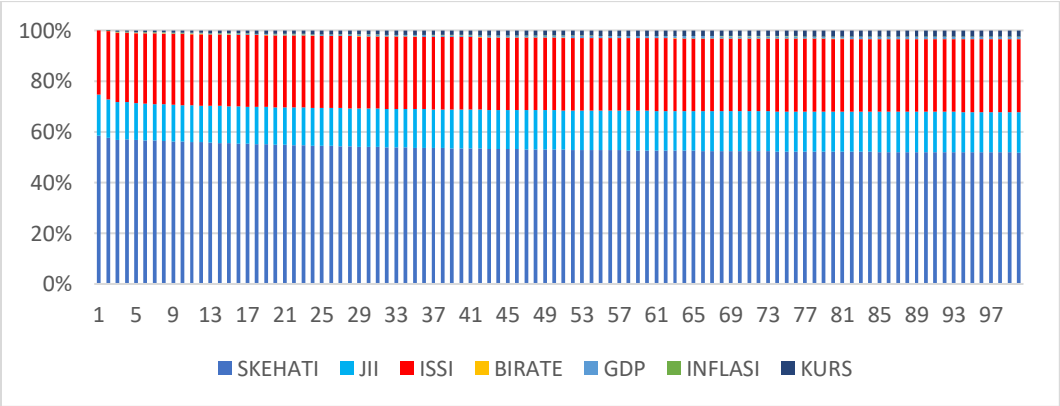

Figure 6 FEVD ISSI Graphic

The FEVD graph for SKEHATI below elucidates the dominant factors influencing SKEHATI, with SKEHATI itself being the primary dominant factor. The second dominant factor influencing SKEHATI is KURS, followed by ISSI and GDP, while BIRATE and INFLASI have a minor influence on this ESG index.

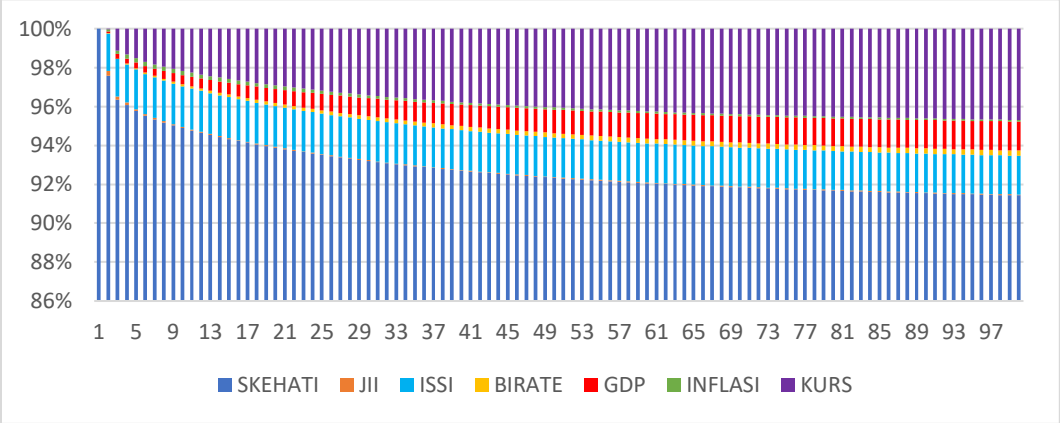

Figure 7 FEVD SKEHATI Graphic

Siswanto et al. (2022) conducted a study on the influence of financial performance, systematic risk, and macroeconomic indicators, resulting in several conclusions. Among them is that macroeconomic factors do not affect the returns of Sharia-compliant stocks, whereas financial performance and systematic risk do have an impact. This is primarily due to the core activities of issuers in the manufacturing sector included in the Islamic index, ISSI, which are not affected by fluctuations or changes in macroeconomic variables.

Unlike the previous studies, this study uses a different method and a longer period that reflects volatility and shocks more representatively, it can be found that the sustainable index impacts both Islamic indices and among the observed macroeconomic variables, exchange rate has a significant impact on SKEHATI. Meanwhile, the Islamic indices is able to respond to shocks faster than the sustainable index.

5. CONCLUSION

In the co-integration analysis, it was found that there is stability or balance and similarity in movements in the long term or in each short-term period. All variables tend to adjust to achieve their long-term equilibrium. The analysis of the impact of macroeconomic shocks on ISSI, JII, and SKEHATI indices was conducted using the VECM method, which resulted in Impulse Response Function showing the indices' responses over the next 100 periods. It can be concluded that macroeconomic shocks only impact the indices from the 3rd to the 7th periods. JII appears to respond faster to shocks compared to ISSI and SKEHATI. Similarly, in Variance Decomposition, it is evident that JII is greatly influenced by the SKEHATI index, itself, and the exchange rate. Likewise, for ISSI, the dominant factors affecting ISSI are SKEHATI and ISSI itself, followed by JII. SKEHATI is heavily influenced by itself as the primary dominant factor and also influenced by the exchange rate as the second dominant factor. Other macroeconomic factors such as GDP and inflation do not significantly affect this ESG index. These results also indicate that the Sharia index exhibits better resilience to macroeconomic shocks compared to the sustainable index, which is still a conventional index.

This research recommends a comprehensive assessment for investors or investment managers to choose one of the three indices for their portfolio and diversification strategies. For broader stakeholders and relevant regulators, the findings of these market trends can be used to formulate effective micro-market structure policies, mutual fund product innovations, incentives for the Sharia sector, or even macroeconomic stabilization policies to mitigate the impact of crises.

The results of this research can serve as an early warning system if there are signs of economic shocks related to exchange rate risks that stakeholders must address for risk management and solid financial stability.

Research on the relationship between macroeconomic shocks and Islamic indices can underscore the significance of ethical and religious factors in guiding their behavior. Understanding the long-term resilience of sustainable and Islamic indices to economic fluctuations offers insights for informed investment decisions and risk management in evolving economic landscapes.

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