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Exploring Diversification Opportunities Across Islamic Stocks, Bitcoin, Oil and Gold in Indonesia

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Abstract

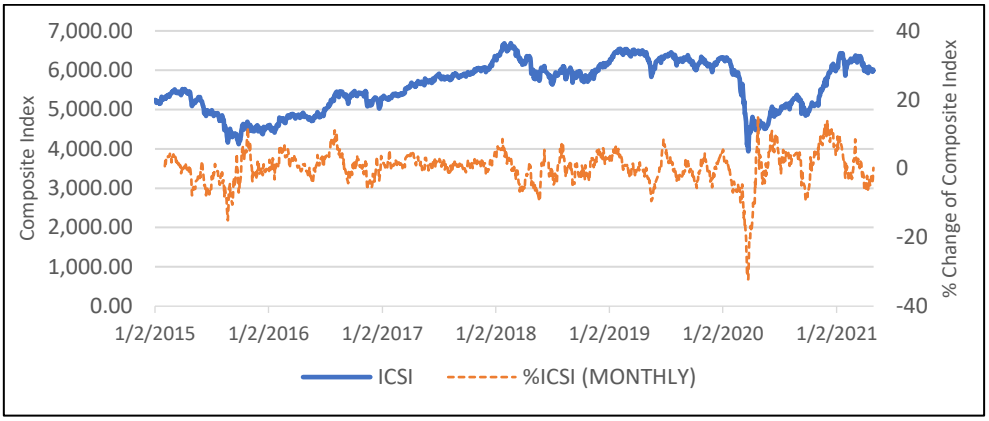
Recognizing the commendable performance of Indonesian Sharia stocks, this study investigates the dynamic relationships among the daily asset prices of Islamic stocks, gold, oil, and Bitcoin before and during the pandemic (January 2015 to December 2021). This study is conducted within the framework of Cointegration, Vector Autoregressive (VAR), Variance Decomposition, and Impulse Response Functions. Full-ranked cointegration is detected in the analysis, implying that VAR is stationary in level; thus, long-term integration is unlikely. VAR results are threefold. First, oil prices demonstrated a strong association with Sharia indices both before and during the pandemic. Second, gold serves as a reliable hedge during normal conditions, but fails to act as a safe haven during the pandemic. Third, Bitcoin is exogenous and functions as a diversifier to mitigate Sharia stock losses, particularly during periods of high uncertainty. However, owing to the high volatility and speculative nature of Bitcoin, short-rather than long-term investments are recommended. These results offer valuable insights, and enhance our understanding of the interrelationships and transmission effects of financial assets in Indonesia. A more precise measurement of asset integration would prove beneficial for risk management and portfolio construction of both Sharia stocks and non-compliant Sharia assets.

Keywords: Sharia Stocks, Gold, Oil, Bitcoin, Portfolio Diversification

Introduction

The outbreak of the Covid-19 pandemic in early 2020 had a profound impact on global investment and economic activity. The market turmoil resulting from the spread of the disease was exacerbated by oil shock events. On March 8, 2020, Saudi Arabia initiated a price war with Russia, leading to a 65% quarterly decline in oil prices, dropping to below $30 per barrel. The combined effects of these events are substantial. On March 9, market panic resulted in what is now known as Black Monday, with global stocks experiencing a downturn of at least 25% and 30% in most G20 nations during the March 2020 crash. In response, many affected countries have implemented interest rate cuts and fiscal expansion measures.

The Indonesia Composite Stock Index (ICSI) plummeted to its lowest point at 3,937.63 on March 24, 2020, with significant monthly fluctuations ranging from -32.2% to +15% until mid-April (Figure 1). From April to August 2020, the composite index continued to fluctuate in the negative territory, emerging only from mid-November 2020. Although the stock market has shown a positive trend since then, it has not fully recovered from the shock and price fluctuations persist. This is primarily due to the depressed performance of most issuers in 2020. As of 2021, the Indonesian Stock Exchange (IDX) has not displayed significant momentum for growth.



Source: Yahoo.finance.com

Figure 1: Indonesia Composite Stock Index (ICSI) and Fluctuations (%) Before and During the Pandemic

Undoubtedly, the pandemic has disrupted daily life and financial markets at an unprecedented scale. However, the decline in the stock index did not affect all companies in Indonesia. Although some companies initially experienced shocks at the start of the pandemic, their performance improved shortly thereafter. Notably, Sharia-compliant stocks have demonstrated remarkable performance compared to conventional stocks, particularly during times of crisis (Aarif et al., 2021; Abdul Karim & Abdul-Rahman, 2020; Al-Yahyaee et al., 2020; Hasan et al., 2021; Jabeen & Kausar, 2022; Shahzad et al., 2019; Usman et al., 2019). Sharia stocks in Indonesia have exhibited a positive performance during the Covid-19 pandemic. Within a month after the first Covid-19 case was reported in Indonesia on March 2, 2020, the three Sharia indexes, namely the Indonesian Sharia Stock Index (ISSI), Jakarta Islamic Index 70 (JII70), and Jakarta Islamic Index (JII), rebounded from shocks. The ISSI increased by 13.9%, JII70 increased by 12.3%, and JII increased by 7.8%. The performances of these three Sharia indices were notably better than those of Liquid 45 (LQ45) and IDX30, which rebounded by 5.1% and 2.4%, respectively. Presently, approximately 70% of issuers in Indonesia are classified as Sharia-compliant. The performance of the Islamic capital market in Indonesia has been recognized with the Best Islamic Capital Market award at the 2020 Global Islamic Finance Awards (GIFA). This achievement can be attributed to the recent growth of the Islamic capital market, innovative products, and inclusion of Corporate Social Responsibility (CSR). Therefore, the Islamic stock market plays a vital role in the economic growth of Indonesia.

According to Modern Portfolio Theory, optimal portfolio diversification cannot be achieved if all asset portfolio prices experience the same cycles and move in the same direction. In the absence of major financial shocks, the integration of financial markets amplifies the effect of total factor productivity shocks, leading to divergent output patterns (Rizvi & Arshad, 2017).

Consequently, investors must analyze the direction and correlation of different asset classes to construct a well-diversified portfolio. Diversification strategies are crucial for risk management as they enable higher returns and reduce the risk associated with individual holdings or securities within a portfolio. Diversification can be applied at various levels, including securities, companies, asset classes, geographical markets, and economies. Gold and oil are often considered safe haven assets for hedging against equity market fluctuations during crises or bearish markets (e.g., Chkili, 2017; Iqbal et al., 2020; Mensi et al., 2017; Robiyanto, 2018), particularly in global financial centers such as the US, UK, and China (Shahzad et al., 2019).

Despite previous studies on the relationship between gold, oil, and conventional stocks in Indonesia (e.g., Adam et al., 2015; Robiyanto, 2020; El-Khoury et al., 2023), limited research exists on the relationship between different financial asset classes and Islamic stock indices. Furthermore, the double impact of the coronavirus and the oil price shock significantly impacted the oil market in 2020, surpassing previously dominant political factors. The price of gold also exhibited a downward trend, reaching $1,951 per ounce on January 5, 2021, marking the worst start to the year in nearly a decade. In April 2021, it declined further to $1,857 per ounce. Both gold and oil display volatilities beyond the expectations of previous studies, and there is no consensus regarding their role as safe havens against equity fluctuations.

Conversely, the emergence of cryptocurrencies, particularly Bitcoin, has attracted significant interest from investors, policymakers, and academics. Since its introduction in 2009, Bitcoin has experienced a tumultuous and volatile trading history characterized by multiple bubbles and bursts largely driven by speculative investments. The price volatility of Bitcoin has been estimated to be over seven times that of gold and over eight times that of stock market indexes such as the S&P 500 (Mishkin, pp104, 2022). Starting from a fraction of a penny, the digital currency reached a high of $255 on April 10, 2013, only to fall back to $55 a week later. Subsequently, it rose to $1,156 in December 2013, but experienced a drastic decline to $200 by June 2015. Bitcoin peaked at $20,000 in December 2017 but crashed to $7,112 by December 2019. However, the world was once again shocked by the explosive surge in Bitcoin prices, surpassing $19,319 by the end of 2020 from $3,600 in March 2020, when the pandemic began.

Bitcoin is increasingly being recognized as an asset capable of hedging against inflation and generating wealth (Kajtazi & Moro, 2019; Mensi et al., 2020; Mroua et al., 2020). Consequently, by the end of 2020, the Indonesian government officially legalized cryptocurrency trading, including Bitcoin trading. The introduction of Bitcoin as a cryptocurrency product has provided new insights for Indonesian investors. Moreover, to the best of our knowledge, no study has analyzed the association between Islamic stocks and Bitcoin in Indonesia considering market integration or causal effects. Motivated by the recent shock caused by the pandemic, we aim to reassess the dynamic linkages and feasibility of systematic risk diversification across Sharia stock, Bitcoin, gold, and oil prices. This study provides insights into improving risk management and portfolio alignment.

The focus of our research is to examine the dynamic relationship between the three aforementioned asset prices (oil, gold, and Bitcoin) and two Islamic stocks (JII, ISSI). The study

period spans from 2015 to 2021, divided into two sub-periods: January 2, 2015, to March 10, 2020 (pre-pandemic, 1260 observations), and March 11, 2020, to April 30, 2021 (during the pandemic, 435 observations). Another Islamic index consisting of more liquid stocks (JII70) was not included in the analysis because of the limited availability of data prior to May 2018. The analysis is conducted within the framework of cointegration, Vector Autoregressive (VAR), Variance Decomposition, and Impulse Response Functions.

The remainder of this paper is organized as follows. Section 2 provides a literature review of portfolio investments and asset integration. The methodological details are presented in Section 3. Section 4 then presents the empirical results and discussion. Finally, Section 5 concludes the paper.

Literature Review

Modern Portfolio Theory (MPT), introduced by Harry Markowitz in 1952, posits that analyzing the return and risk of assets should involve a multivariate approach rather than considering them individually. To achieve an optimum combination, investors must assess and compare multiple variables across different assets. The MPT also suggests that diversifying investments across assets with low correlations can reduce systematic risk and enhance portfolio efficiency.

According to Flood and Rose (2004), financial markets are integrated when assets are priced using the same stochastic discount rate. When assets in international financial markets exhibit similar expected returns at a certain level of risk, they are considered integrated. Complete financial integration implies that homogeneous assets have identical prices and characteristics. However, correlation alone is insufficient as a measure of financial integration and portfolio diversification because it fails to capture the presence of long-term stationarity between the measured financial variables. Johansen (1988) proposes that cointegration analysis is necessary to detect long-term equilibrium and the existence of integrated variables that exhibit the same stochastic trend and will move together in the long run. Consequently, cointegration analysis can also be used to analyze the co-movement between financial assets. Thus, assets with low or zero co-movement can be combined into a portfolio as part of a diversification strategy in line with MPT, aiming to create an efficient portfolio structure based on assets with low co-movement.

During downturns or periods of turmoil, investors typically divest risky assets and reallocate their funds to less risky alternatives. This flight to safety phenomenon occurs as a response to market uncertainty. In recent decades, the Sharia stock market has witnessed significant development and become appealing because of its characteristics as a flight-to-quality option during market downturns. Regional and global crises have compelled investors to seek safe haven avenues such as Islamic financial markets. Consequently, there has been an increasing focus on measuring the integration of Islamic markets to mitigate risk, establish rigorous regulatory mechanisms, maintain financial stability, and enhance asset quality. The Islamic stock market not only benefits various financial sectors, such as mutual funds, conventional stock markets, banking, and insurance, but also contributes significantly to countries' economic growth (Abedifar et al., 2016). Research by Kenourgios et al. (2016) confirms the supportive performance of Islamic stock market indices during financial crises, indicating their role in reinforcing the soundness of economies. Other studies suggest that Shariah securities are considered safe havens during market downturns because of their weak connections with other portfolio securities (Alqahtani & Mayes, 2018; Saiti et al., 2014; Salisu et al., 2020;

Shahzad et al., 2019). In terms of cointegration, market upheavals impact not only performance, but also the level of cointegration. Saiti et al. (2014) and Al-Yahyaee et al. (2021) observe that Islamic equities exhibit lower volatility and provide greater diversification opportunities during market downturns. Consequently, due to diminishing diversification opportunities resulting from market integration, investors are advised to diversify their portfolios by including different types of financial assets, such as bonds, commodities, and currencies.

Gold, as an essential commodity, exhibits lower risk and potential for relatively high returns. Its value in the monetary and financial sectors is derived from its absolute monetary worth relative to currencies worldwide. The appealing attributes of gold, such as its role as a safe haven and hedge, have significantly increased its attractiveness to investors and practitioners in the international market. Scholarly works by Choudhry et al. (2015) and Malliaris & Malliaris (2015) highlight the substantial influence of gold on stock market trading, portfolio balancing, and the shaping of financial policies and economic frameworks. Notably, during the global financial crisis, the price of gold tended to rise as the US market uncertainty index increased. This is attributed to risk-averse investors seeking refuge in safe haven assets such as gold to safeguard their portfolio equity value amidst market uncertainty (Baur & Lucey, 2010; Będowska-Sójka & Kliber, 2021; Nedved & Kristoufek, 2023; Sarwar, 2017). Troster et al. (2018) argue that including gold in a portfolio combines the features of risky assets (stocks) and safe haven assets (gold).

The relationship between gold and the Sharia stock market has been extensively explored, yielding mixed and sometimes contradictory results. Some studies support the role of gold as a hedge for Sharia stock movements (Maghyereh & Abdoh, 2021; Mensi et al., 2019), whereas others propose the safe haven hypothesis for gold (Bredin et al., 2015; Chkili, 2017). However, some studies have demonstrated that gold and Sharia stocks offer the best combination for constructing effective diversification and portfolio optimization strategies (Alkhazali & Zoubi, 2020; Mensi et al., 2017). Maghyereh and Abdoh (2021) emphasize the significant role of gold as a hedge, safe haven, and diversifier for Shariah stock portfolios in the long term. Naeem et al. (2021) investigated the relationship between gold and Islamic stocks under divergent financial conditions, namely bearish, normal, and bullish conditions. Interestingly, they find that the association between two assets differs depending on the conditions. Under extreme conditions, gold and Islamic stocks tend to move in similar patterns, suggesting limited diversification benefits. However, they also observe that these assets tend to be disassociated under normal conditions. The diverse findings in prior studies can be attributed to variations in the sample, chosen time period, and methodological differences.

On the other hand, crude oil is also a crucial indicator in today's global economy due to its volatility, which is influenced by economic and political events. The global oil price holds immense significance as crude oil can be refined into various energy sources such as liquefied petroleum gas (LPG), gasoline, diesel, and lubricating oil. Both developed and developing countries are greatly affected by global oil prices. Moreover, after experiencing successive episodes of economic crises in different parts of the world at various times (such as the Covid-19 pandemic, the 2008 global crisis, the European debt crisis, and the 2016 Brexit), investors have become interested in understanding the potential impact of oil price volatility on global financial markets, particularly focusing on stock market returns (Jawad et al., 2017). The rationale behind the influence of oil prices on the stock market lies in their direct impact of oil prices on the revenues and cash flows of businesses. It has been found that the nature of their relationship varies and depends on the country and the time horizon. While oil price

volatility is deemed important for both conventional and Islamic stock markets, its impact is particularly relevant for Islamic stocks given that most oil-producing countries are Islamic countries. These countries share and transfer their risks during times of financial turmoil (Chang et al. 2020).

Numerous studies have examined the relationship between stock, oil, and gold prices. Nagayev et al. (2016) find that the correlation between the Dow Jones Islamic Market Index and several commodities exhibits persistent variation. This correlation fluctuated significantly between January 1999 and April 2015, particularly during the 2008 Global Financial Crisis. However, the correlation decreased during the last two years of the study. Additionally, the research highlighted that Gold, Natural Gas, Soft Commodities, Grains, and Livestock could serve as safe haven assets during times of crisis. Gold plays a crucial role in Islamic markets and is negatively correlated with Islamic stock price indices, especially during crises. Gold possesses the characteristics of a weak hedge and robust safe-haven asset for the Islamic stock market. Hence, investors can include gold in their portfolios to reduce risk levels and enhance their hedging capabilities (Chkili, 2017; Raza et al., 2016). In Indonesia, gold acts as a hedge for Islamic stocks (Robiyanto 2018). Moreover, this study found that gold can serve as the safest asset for Islamic stocks in Indonesia when there is an extreme shock in the stock market. Investors are advised to transfer their assets to gold to safeguard their investments during the sharp decline in the capital market.

Similar results were obtained by Jawad et al. (2017), who analyzed the relationship between gold, global oil prices, and Islamic and conventional stock indices on the Dow Jones Global Index. The study period spanned from November 9, 1998, to March 5, 2015. The analysis employed the multivariate dynamic equicorrelation-fractionally integrated asymmetric power autoregressive conditional heteroskedasticity (Deco-Fiaparch) method. The results showed varying levels of correlation during the study period. Prior to 2012, the correlation between commodities and the stock market was relatively high, particularly during the Global Financial Crisis in 2008-2009. However, the correlation level continued to decline after 2012, indicating wider opportunities for diversification strategies. Furthermore, the study revealed that the energy, finance, technology, and communication sectors played the role of receivers, whereas the Dow Jones Islamic Market Index, Consumer Goods Sector, Consumer Services, Healthcare, Industrials, and Utilities tended to contribute to the correlations. Additionally, gold exhibited better diversification opportunities than oil.

Through a screening process involving factors such as the debt ratio, the Islamic stock market, as part of Islamic finance, demonstrates a lower risk level than the conventional market. Trabelsi (2019) asserts that the Islamic stock market provides relatively high diversification opportunities. This research provides empirical evidence that the Islamic stock market in various global countries exhibits a negative correlation with major assets, namely gold, crude oil, and bonds. Regarding international portfolio diversification, global countries played a more significant role as contributors, whereas developing countries played a more substantial role as receivers. Thus, it is evident that changes in economic conditions, both domestically and globally, significantly affect the movement of the Sharia stock index. Mishra et al. (2019) provided empirical evidence that time or period acts as a moderator in explaining the relationship between stock prices and oil prices. Through their study of Islamic stock indices and oil prices, they observe a justifiable yet time-varying relationship. Global oil price fluctuations had a positive short-term effect on the Islamic index but exhibited a negative correlation in the long term. These findings contribute to the evaluation of diversification

strategies across various time horizons. Additionally, policymakers must minimize uncertain information regarding global oil prices to prevent turbulence in the stock market.

However, the emergence of Bitcoin as a blockchain product has expanded investment options for investors. Despite not complying with Sharia regulations owing to its highly speculative nature, this asset, which offers high returns but is volatile, has attracted the attention of fund managers, portfolio investors, and academia. Numerous scholars have attempted to assess the role of Bitcoin in wealth creation and systematic risk reduction by comparing it to other financial assets, such as stocks, gold, and bonds. Some researchers argue that Bitcoin can serve as a safe haven asset during crises (Akhtaruzzaman et al., 2019; Huang et al., 2021; Chan et al., 2019; Kajtazi & Moro, 2019; Mensi et al., 2020; Smales, 2019), while others have found that Bitcoin is a weak safe haven against the equity market (Będowska-Sójka & Kliber, 2021; Conlon & McGee, 2020; Nedved & Kristoufek, 2023 ; Yarovaya et al., 2020). Kajtazi & Moro (2019) examined the cointegration of conventional stocks with Bitcoin and revealed that Bitcoin plays a significant role in improving portfolio performance and provides diversification benefits. Similarly, Mensi et al. (2020) analyzed the relationships between Bitcoin, the Dow Jones Global Market Index, and regional Islamic indices. The study indicated that Bitcoin served as an endogenous variable, with its price movements causing effects on stock indices. Therefore, the diversification benefit of Bitcoin is lower for long-term Shariah investors than for short-term investors. Mroua et al. (2020) further highlighted Bitcoin as a good hedge against inflation and recommended its inclusion in portfolios because of its relatively high risk-adjusted return.

Fama (1970) defines an efficient market as one that provides perfect stock price information to investors. Accordingly, an efficient capital market can account for the phenomenon of the COVID-19 pandemic, where stock returns are positively correlated with systematic risk. In other words, the less information a company provides to investors about its stock returns, the less interested investors will be in the company. The COVID-19 pandemic has further amplified systematic risk, leading investors to become risk averse. Fama (1970) states that the challenge in testing the efficient market theory lies in the fact that investment decisions are based on the assumption that prices fully reflect available information and that investors avoid risk. Kassim (2013), who examined the impact of the 2007 global financial crisis on the integration of Islamic stock markets, reveals that both conventional and Islamic stock markets were adversely affected by the global financial crisis. However, Islamic stock returns in developing countries outperform those in developed ones. This study also demonstrates that the global financial crisis affected the integration process of Islamic stock markets, as a long-term equilibrium relationship was observed during the crisis period.

The literature review examined various empirical pieces of evidence to develop a comprehensive understanding of the interrelationships between the Islamic stock market, gold, oil, and Bitcoin. Building upon previous studies, this research also explores the impact of the COVID-19 pandemic on market integration. The following hypotheses were proposed to analyze the dependencies among these assets:

Hypothesis 1: There is a dynamic relationship between the Indonesian Sharia Stock Indices, gold, oil, and Bitcoin in the pre-pandemic period.

Hypothesis 2: There is a dynamic relationship between the Indonesian Sharia stock indices, gold, oil, and Bitcoin during the pandemic.

Methodology

Data and Variables

Indonesia has three types of Islamic stock. First, the Jakarta Islamic Index (JII) was the first Islamic stock index launched in the Indonesian capital market, precisely on July 3, 2000, or almost 21 years ago. JII constituents consist of only 30 Sharia stocks, with the most liquid assets listed on the IDX. Second, the Indonesia Sharia Stock Index (ISSI) contains all Sharia stock compliance in Indonesia. ISSI indicates the overall performance of the Indonesian Islamic capital market. As of December 2020, issuers at the ISSI comprised 423 companies. JII70 was the third Islamic stock index launched by the IDX on May 17, 2018. The JII70 constituents are slightly more abundant than JII, with the 70 most liquid Islamic stocks listed on the IDX. However, JII70 was not included in this study because JII70 only been available since its launch in 2018.

In the present study, we analyze the dynamic relationship of three financial asset prices (Oil, Gold, Bitcoin) with two Islamic stocks (JII, ISSI). All daily asset prices from January 2015 to April 2021 were sourced from Yahoo Finance and cross-checked with the Indonesia Stock Exchange (IDX). The period of analysis was divided into two sub-periods: January 2, 2015, to March 10, 2020, as the pre-pandemic period (1260 observations), and March 11, 2020, to December 30, 2021, as the pandemic period (435 observations). The assessment of interdependence between variables is conducted within the dynamic framework of cointegration, vector autoregression (VAR), Variance Decomposition and Impulse Response Functions. The econometric procedure is presented in the following section of analysis methods. All series were transformed into natural logarithms before econometric analysis.

Analysis Methods

Determining the optimal lag length is important for the VAR-type Johansen cointegration test. In general, several parameters can be used to determine the optimal lag length, including AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion). The optimal lag length is determined using the VAR equation with the smallest AIC or SIC values. The k-value for the lag length was determined in advance from the stable VAR equation until the maximum lag generated by the VAR system was obtained. The Johansen procedure has limited opportunities to test the cointegration vector shapes. To test the constraints on the cointegration vector, Johansen (1988) determined two matrices, α and β, both with dimensions (p × r), where r is the rank of n. Therefore,

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

where α represents the matrix weight of each cointegration vector of size n × r, and β represents the cointegration parameter matrix of size r × n. The definition of a vector in the Johansen approach begins with a vector of n potential endogenous variables, Y_t. which was assumed to be a VAR system that was unrestricted and lagged.

$$Y_t = A1Y_{-1} + \ldots + AkY_{t-k} + \varepsilon_t \quad (2)$$

where Y_t denotes A vector with the k non-stationary variables I (1), A is the Matrix parameter, and ε_t is the error vector. Decision-making was rejected if the trace test statistics and maximum eigenvalues were > critical value at α, or p-value < significance value α, at the significance level (1- α) 100%. If cointegration exists, the next step is to estimate the Vector Error Correction Model (VECM). Otherwise, VAR is further estimated.

The next procedure after cointegration is the estimation of VAR, first initiated by Sims (1980), which was the developed procedure of the Autoregressive Distributed Lag (ADL) model. VAR loosens the assumption of exogenous variables in ADL. Within the VAR system, it

is possible to estimate a series of variables suspected to be endogenous. In this case, the relationship between economic variables can be estimated by disregarding the issue of exogeneity. In general, the VAR model that is unrestricted and has up to -lags is as follows:

$$Y_t = A1Y_{t-1} + ... + ApY_{tp} + \varepsilon_t \quad (3)$$

where Y_t is A vector with the k variables, A is the Parameter matrix, whereas ε_t is the Error Vector. The Granger Causality Test is then performed to gauge the causal effect(s) among the variables. Based on the Granger causality hypothesis (Widarjono, 2012), a causality test is conducted to determine whether an endogenous variable can be treated as an exogenous variable. This stems from ignorance of the interdependence between the variables. If there are two variables Y and Z, then whether Y causes Z or Z causes Y applies both, or there is no relationship between the two. The Y variable causes the Z variable, meaning how much the Z value in the current period can be explained by the Z and Y values in the previous period.

The dynamic behavior of the VAR model can be seen through the response of each variable to the shock of these variables and other endogenous variables. There are two ways to see the dynamic characteristics of the VAR model: through the Impulse Response Function and Variance Decomposition. IRF measures the magnitude (change in percent), orientation (increase or decrease), and length (how long the shock affects the dependent variables) of the response and evaluates the speed of the transmission mechanism in operation. Variance Decomposition is useful for measuring the estimated error variance of a variable, namely, the ability of a variable to explain other variables, or the variable itself.

Results and Analysis

Table 1

Descriptive Statistics

Variables	Minimum	Maximum	Mean	Std. Dev	CV	Skewness	Kurtosis
Pre-Pandemic							
JII	541.400	798.770	686.223	48.487	0.071	-0.503	-0.125
ISSI	131.610	199.610	174.059	14.936	0.086	-0.917	0.036
Gold	1070.800	1697.100	1345.889	106.809	0.079	0.503	0.508
Oil	26.210	76.410	52.996	9.260	0.175	0.000	-0.028
Bitcoin	164.900	18972.300	4152.182	4025.006	0.969	0.749	-0.338
During Pandemic							
JII	393.860	671.590	564.242	44.813	0.079	-0.007	4.038
ISSI	115.950	191.000	166.638	17.826	0.106	-0.512	2.003
Gold	1487.100	2049.300	1812.358	85.870	0.047	-0.352	4.552
Oil	10.010	84.650	54.203	17.788	0.328	-0.249	2.064
Bitcoin	4826.000	67526.900	31627.730	19555.050	0.618	0.092	1.468

Notes: Std Dev denotes for standard deviation, CV denotes for the coefficient of variation

Table 1 presents the descriptive statistics for each research variable. This table shows that there has been a decline in the average stock price index of JII and ISSI before and during the pandemic. This is distinctive to the prices of oil, gold, and Bitcoin, which increased during the pandemic compared to before the pandemic. Judging from the Coefficient of Variation, there was an increase in the CV at JII, ISSI, and oil prices. This indicates that, during a pandemic, the three variables are more volatile. Meanwhile, Gold and Bitcoin, which show a decline in CV value, indicate that these two variables are moving more stably during the pandemic. On the other hand, Bitcoin is the most volatile asset.

To examine the data properties, the augmented Dickey–Fuller (ADF) test for a unit root was applied at the 5% significance level. If the value of the t-statistics in the ADF test is greater than the critical value of McKinnon, it can be concluded that the data are stationary. Otherwise, the data are not stationary and the unit root test is performed at the level of 1st difference. From Table 2, it can be seen that none of the variables are stationary at the level because the t-statistic value is less than the Mackinnon Critical Value. However, all variables are stationary at 1st difference. This means that all the variables are integrated in the order of 1 or I (1).

Table 2
Stationarity Test

Variable	ADF Test Statistics		MacKinnon Critical Value	
	Level	1st Difference	Level	1st Difference
Pre-pandemic				
JII	-2.193	-35.453*	-2.864	-2.864
ISSI	-1.563	-34.429*	-2.864	-2.864
Gold	-0.593	-34.316*	-2.864	-2.864
Oil	-1.955	-37.125*	-2.864	-2.864
Bitcoin	-1.447	-36.166*	-2.864	-2.864
During Pandemic				
JII	-1.875	-13.449*	-2.868	-2.872
ISSI	-1.055	-13.036*	-2.868	-2.872
Gold	-2.933	-16.802*	-2.868	-2.872
Oil	-0.837	-12.241*	-2.868	-2.872
Bitcoin	-1.187	-15.998*	-2.868	-2.872

Note: * represent significance at the 5% levels

The next step is to determine the optimal lag, which is useful for eliminating the autocorrelation problem and for producing the best VAR model. Optimal lag assessment was based on the smallest AIC value. Table 3 shows that the optimal lag is lag 2 during the pre-Covid-19 pandemic. Meanwhile, during the Covid-19 pandemic, the optimum lag was 1. A VAR system is declared stable if all the roots have a modulus of less than 1. Based on the VAR stability test results in Table 4, the modulus values for the variable JII. ISSI. Gold, Oil, and Bitcoin are worth less than 1. This implies that the VAR system has been stable for both the periods before and during the Covid-19 pandemic. Therefore, VAR estimation can be used for Impulse Response Function (IRF) and Forecasting Error Variance Decomposition (FEVD).

Table 3
Optimum Lag Length test

Lag	Log L	LR	FPE	AIC	SC	HQ
Pre-Pandemic						
0	-21024.070	NA	3.41e+08	33.836	33.857	33.844
1	-20911.150	224.752	2.96e+08	33.694	33.818*	33.741*
2	-20881.210	59.344	2.93e+08*	33.687*	33.913	33.772
3	-20863.830	34.309	2.97e+08	33.699	34.029	33.823
4	-20851.700	23.865	3.03e+08	33.719	34.152	33.882
During Pandemic						
0	-8199.199	NA	3.68e+10	38.51736	38.56495*	38.53616*
1	-8165.556	66.33784	3.53e+10*	38.47679*	38.76231	38.58958
2	-8143.404	43.15962	3.58e+10	38.49016	39.01362	38.69694
3	-8122.832	39.59835*	3.65e+10	38.51095	39.27235	38.81172
4	-8112.234	20.15143	3.91e+10	38.57856	39.57790	38.97332

Note: *represents the lowest value of lag length criteria among others

Table 4
VAR stability test Results

Pre Covid-19 Pandemic Period	Modulus Range: 0.222 - 0.407
Covid-19 Pandemic Period	Modulus Range: 0.343 - 0.360

Table 5 presents the cointegration test results. At lag 2, cointegration is confirmed for the pre-pandemic period with trace statistics and maximum eigenvalues greater than the critical values at a significance level of 5%. This means that the null hypothesis of no cointegration is rejected and the alternative hypothesis of cointegration cannot be rejected. Therefore, among the five variables in this study, there are at least five cointegration equations at the 5% significance level. This result also applies to the data collected during the pandemic. However, because the number of cointegrations is equal to the number of variables, it is considered full rank cointegration. This contradicts the results of the univariate unit root test, which exhibits nonstationary data at the levels. According to Juselius et al. (2000), full rank cointegration implies that there are n independent linear combinations of variables that are stationary. This means that all variables must be stationary in the first place, which implies that the VAR is stationary in the levels. This reveals the deficiency of the ADF test results reported in Table 2, which coincides with studies that explore the shortcomings of the ADF test. Hence, the next step is to determine the relationship between variables using the VAR model.

Table 5
Johansen Co-integration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value
Pre-Pandemic			
None *	0.491	2921.343	60.061
At most 1 *	0.371	2072.789	40.175
At most 2 *	0.358	1490.823	24.276
At most 3 *	0.318	934.416	12.321
At most 4 *	0.304	454.164	4.1299
During Pandemic			
None *	0.602	1593.367	76.973
At most 1 *	0.555	1194.045	54.079
At most 2 *	0.514	843.765	35.192
At most 3 *	0.506	531.078	20.262
At most 4 *	0.406	225.853	9.165

Note: *refers to rejection of the hypothesis at the 0.05 level.

Table 6
VAR Estimation during the Pre-Pandemic

Variables	Dependent: JII		Dependent: ISSI	
	Coefficient	t-statistic	Coefficient	t-statistic
JII(-1)	0.929	6.328*	-0.012	-0.397
JII(-2)	0.029	0.641	0.029	0.709
ISSI(-1)	0.286	0.385	1.073	7.296*
ISSI(-2)	-0.929	-0.876	-0.217	-1.034
GOLD(-1)	0.019	1.559	0.005	1.935
GOLD(-2)	-0.013	-0.956	-0.003	-1.174
OIL(-1)	-0.493	2.705*	0.098	2.723*
OIL(-2)	-0.589	2.322*	-0.124	-2.469*
BITCOIN(-1)	-0.002	-0.269	0.000	-0.268
BITCOIN(-2)	0.000	0.097	0.000	-0.079

Note: *refers to the rejection of the hypothesis at the 0.05 level

VAR estimations are conducted (JII and ISSI as dependent variables) based on the result of the Lag Length criteria, which found two lags in the pre-pandemic period and one lag in the pandemic period. Table 6 shows that oil prices in the previous period had a significant effect on both JII and ISSI. This effect is negative, implying an inverse relationship between oil and stock prices. Indonesia is one of the largest oil-importing countries in Southeast Asia in the world. In oil-importing countries, a rise in oil prices will result in higher production costs, which will raise consumer prices and thereby drive lower demand and production capacity. Hence, the stock market reacts negatively (Hadhri 2021). This result indicates that this commodity has a strong correlation with the Sharia stock price index and is not recommended for use as a portfolio diversifier. Meanwhile, other variables, namely, Gold and Bitcoin in the previous period, did not show a significant effect on the Sharia stock price index, implying high opportunities for diversification benefits across these assets. This result is consistent with those of Akhtaruzzaman et al. (2019) and Huang et al., (2021), and Wang et al., (2019), who revealed that Bitcoin has hedge features during normal conditions owing to its lower correlation with traditional assets and independency from monetary policies. On the other

hand, the role of gold as potential diversifier during the pre-pandemic confirms the previous studies by Alkhazali & Zoubi (2020) and Baur & McDermott (2010). In the context of the Indonesian market, this finding supports the study conducted by Robiyanto (2018), which specifically analyzed the relationship between Sharia Stock and Gold in Indonesia. The VAR modeling results also show that JII and ISSI are endogenous, in which oil moves as a driver for the two stock indices.

Table 7
VAR Estimation during the Pandemic

Variables	Dependent: JII		Dependent: ISSI	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
JII(-1)	0.384	1.871	0.053	1.139
ISSI(-1)	-2.089	-2.291*	-0.284	-1.383
GOLD(-1)	0.061	3.158*	0.013	2.926*
OIL(-1)	0.754	2.826*	0.190	3.159*
BITCOIN(-1)	0.000	0.859	0.000	1.277

Note: *refers to the rejection of the hypothesis at the 0.05 level

Table 7 shows that during the Covid-19 pandemic, Gold and Oil significantly influenced the movement of both the JII and ISSI. This result posits a consistent relationship between oil prices and the Sharia stock market, which supports numerous prior studies stating that oil markets affect the global market as a whole (Akkoc & Civcir, 2019; Al-Yahyaee et al., 2020; Chang et al., 2020; Hadhri, 2021; Nagayev et al., 2016; Sui et al., 2021; Trabelsi, 2019; Yarovaya et al., 2020). However, their relationship is positive. This is because, similar to other assets, oil prices drop sharply, followed by an increase in volatility. This is in line with Badeeb and Lean. (2018), which suggests that the relationship between oil and stock prices tends to be inconsistent, particularly in oil-importing countries. During the pandemic, both markets were in bearish conditions; thus, the speculative nature of investors tended to increase (Chang et al., 2020). Furthermore, the correlation coefficient is higher than in the normal period, implying that Islamic stock prices respond more aggressively to oil price volatility in times of turmoil (Hadhri, 2021; Taicir, 2018). This result confirms the limited opportunities for diversification between these assets. Meanwhile, Bitcoin is still uncorrelated with Sharia indices, which indicates that Bitcoin has limited-safe haven features to Sharia indices during the pandemic and could offer a diversification benefit. These results are consistent with those reported by Akhtaruzzaman et al. (2019), Huang et al. (2021), Chan et al. (2019), Kajtazi & Moro (2019), Mensi et al. (2020), and Smale (2019). In addition, gold shows a marginally significant influence on JII and ISSI during the pandemic period. Investors should consider this when they intend to include gold in their Sharia portfolio. This result confirms previous studies that reject the role of gold as a safe haven under extreme conditions (Baur & McDermott, 2010; Chkili, 2017; Naeem et al., 2021; Raza et al., 2016).

Table 8
Granger Causality Test Results

Null Hypothesis	Pre-Pandemic			During Pandemic		
	N	F-Sta	P-value	N	F-Sta	P-value
ISSI does not Granger Cause JII	1260	0.07793	0.9250	435	0.90237	0.8065
JII does not Granger Cause ISSI	1260	0.30515	0.7371	435	0.52900	0.3726
GOLD does not Granger Cause JII	1260	1.11095	0.3296	435	4.33256	0.0097*
JII does not Granger Cause GOLD	1260	0.67246	0.5106	435	1.15116	0.2424
OIL does not Granger Cause JII	1260	4.40559	0.0124*	435	3.69390	0.9505
JII does not Granger Cause OIL	1260	3.21093	0.0407*	435	6.57102	0.1670
BITCOIN does not Granger Cause JII	1260	0.06251	0.9394	435	0.88804	0.8734
JII does not Granger Cause BITCOIN	1260	0.52531	0.5915	435	1.33962	0.0935
GOLD does not Granger Cause ISSI	1260	1.67451	0.1878	435	3.81969	0.0314*
ISSI does not Granger Cause GOLD	1260	1.21475	0.2971	435	1.67767	0.1789
OIL does not Granger Cause ISSI	1260	4.05376	0.0176*	435	2.92980	0.1759
ISSI does not Granger Cause OIL	1260	3.43187	0.0326*	435	8.35647	0.0351*
BITCOIN does not Granger Cause ISSI	1260	0.07157	0.9309	435	1.45851	0.2710
ISSI does not Granger Cause BITCOIN	1260	1.32997	0.2649	435	2.15665	0.0063*
OIL does not Granger Cause GOLD	1260	0.93597	0.3925	435	2.62149	0.5165
GOLD does not Granger Cause OIL	1260	0.24766	0.7807	435	0.45124	0.4051
GOLD does not Granger Cause BITCOIN	1260	0.18509	0.8310	435	1.57860	0.6530
BITCOIN does not Granger Cause GOLD	1260	3.54535	0.0291*	435	0.28215	0.7544
BITCOIN does not Granger Cause OIL	1260	1.33638	0.2632	435	4.77938	0.1112
OIL does not Granger Cause BITCOIN	1260	0.06911	0.9332	435	0.55837	0.1540

Note: *refers to the rejection of the hypothesis at the 0.05 level

Moving on, the results of Granger Causality Test are presented in Table 8. The short-term relationships between variables can be unidirectional or bidirectional. Based on the table, in the pre-covid-19 pandemic, it can be seen that a bi-directional relationship occurred between ISSI and the Oil Price, and JII with the Oil Price. This shows that, in this period, the oil price and the two Islamic stock indices in Indonesia influenced each other. Similar findings were reported by Ciner et al. (2013) and Trabelsi (2019). Meanwhile, a unidirectional relationship occurs between Gold and Bitcoin, where Bitcoin affects gold price movements. From an investment perspective, many similarities were found between bitcoin and gold. This two assets are scarce and limited, have no nationality and obtained from “mining”. Wang et al., (2019) also found the bitcoin’s ability as a hedge is similar as gold. This explains the causal relationship between these two assets.

In addition, the relationship between Gold and the Islamic stock index in Indonesia was distinctive during the two periods. While Gold does not granger sharia stocks in the pre-pandemic period, a unidirectional relationship has been found between the two markets. This result supports the finding of Maghyereh & Abdoh (2021), Raza et al. (2016), and Troster et al. (2018). This is also in line with the VAR estimation and indicates that gold is not suggested as a diversifier for sharia stocks during the crisis period. Furthermore, Bitcoin tends to have no relationship with other assets, both before and during the pandemic.

Variance decomposition is used to compile the forecast error variance of a variable, namely, the distinction between the variance before and after the shock, both shocks originating from oneself and shocks from other variables to see the relative influence of the research variables on other variables. The variance decomposition procedure measures the percentage of surprises for each variable; the results are listed in Table 9. In the pre-pandemic period, the

results of the variance decomposition analysis showed that in period 6, the 95.89% variance JII was explained by itself; this percentage declined until the 24th period, and 3.68% of the JII variance was explained by ISSI. Bitcoin, Gold and Oil made relatively small contributions to the JII. The ISSI index tends to have a higher self-dependency compared to JII. In the 6th period, the 99.67% variance in ISSI was explained by itself and was still high in the 24th period. This is because the ISSI is representative of the Sharia stock index in Indonesia, which has a large proportion of market capitalization to the composite stock index. In the 24th period, ISSI's contribution of ISSI declined to 88.16%, whereas the rest was mostly explained by JII (3.5%) and Bitcoin (7.03%). Bitcoin also has high dependency and is relatively less influenced by other variables. In contrast, oil contributed significantly to JII and ISSI. This result follows the VAR estimation, which shows that Bitcoin tends to act as a driver for the movement of ISSI and JII in the pre-pandemic period.

During the pandemic, there was a change in the contribution of each variable to other variables. Overall, these variables experienced a decline in self-dependency, so the percentage contribution of other variables increased. In Period 6, JII had the smallest self-dependency, which was only 95.89%. Similar to the pre-pandemic period, ISSI contributed significantly to JII. Likewise, Oil experienced a significant decline in self-dependency, with bitcoin and JII having high contributions of 11.36% and 13.36%, respectively. Overall, covid-19 has reduced self-dependency on most financial assets. This indicates that during the crisis, the Islamic stock price index, gold, oil, and Bitcoin became increasingly integrated. These phenomena explain the flight-to-quality phenomenon commonly occurring during crises. Investors tend to find safe haven assets to evade downside risk during disastrous market conditions, leading to domino capital movement across financial assets (Corbet et al., 2020; Naeem et al., 2021; Yarovaya et al., 2021).

Table 9
Variance Decomposition Analysis

Period	Variable	JII	ISSI	Gold	Oil	Bitcoin	Total	Self-Dependency
Pre-Pandemic								
	JII	95.89%	3.79%	0.08%	0.23%	0.00%	100%	95.89%
	ISSI	0.00%	99.67%	0.12%	0.19%	0.01%	100%	99.67%
6	Gold	0.12%	0.74%	98.26%	0.74%	0.13%	100%	98.26%
	Oil	0.41%	2.62%	0.02%	96.71%	0.24%	100%	96.71%
	Bitcoin	0.00%	0.13%	0.00%	0.03%	99.82%	100%	99.82%
	JII	96.01%	3.81%	0.05%	0.13%	0.00%	100%	96.01%
	ISSI	0.00%	99.81%	0.07%	0.11%	0.01%	100%	99.81%
12	Gold	0.11%	0.76%	96.84%	1.81%	0.47%	100%	96.84%
	Oil	0.44%	4.10%	0.09%	94.98%	0.38%	100%	94.98%
	Bitcoin	0.00%	0.23%	0.01%	0.02%	99.73%	100%	99.73%
	JII	96.03%	3.75%	0.08%	0.12%	0.00%	100%	96.03%
	ISSI	0.01%	99.72%	0.13%	0.12%	0.01%	100%	99.72%
18	Gold	0.09%	0.69%	94.89%	3.29%	1.01%	100%	94.89%
	Oil	0.42%	5.86%	0.23%	92.92%	0.51%	100%	92.92%
	Bitcoin	0.02%	0.33%	0.03%	0.01%	99.58%	100%	99.58%
	JII	95.95%	3.68%	0.17%	0.18%	0.01%	100%	95.95%
	ISSI	0.03%	99.45%	0.28%	0.03%	0.02%	100%	99.45%
24	Gold	0.08%	0.61%	92.53%	5.07%	1.69%	100%	92.53%
	Oil	0.39%	7.84%	0.59%	90.54%	0.63%	100%	90.54%
	Bitcoin	0.04%	0.50%	0.07%	0.01%	99.37%	100%	99.37%
During Pandemic								
	JII	4.89%	88.72%	3.61%	0.45%	2.32%	100%	91.42%
	ISSI	0.01%	93.35%	3.60%	0.97%	2.07%	100%	89.52%
6	Gold	0.22%	0.34%	97.93%	1.66%	0.04%	100%	96.93%
	Oil	0.03%	0.22%	0.29%	98.62%	0.85%	100%	87.54%
	Bitcoin	0.00%	1.26%	0.39%	0.09%	98.26%	100%	97.15%
	JII	4.87%	81.28%	8.92%	0.29%	4.64%	100%	88.69%
	ISSI	0.04%	86.52%	8.43%	1.08%	3.93%	100%	85.21%
12	Gold	0.10%	1.29%	95.63%	2.85%	0.12%	100%	94.36%
	Oil	0.11%	0.89%	1.19%	96.27%	1.53%	100%	78.51%
	Bitcoin	0.00%	5.08%	0.96%	0.32%	93.63%	100%	91.96%
	JII	4.87%	82.30%	13.92%	0.22%	7.05%	100%	88.65%
	ISSI	0.06%	79.65%	13.06%	1.35%	5.88%	100%	82.30%
18	Gold	0.22%	1.29%	92.99%	4.08%	0.22%	100%	91.25%
	Oil	0.24%	1.86%	2.49%	93.07%	2.35%	100%	72.08%
	Bitcoin	0.00%	10.15%	1.14%	0.55%	88.15%	100%	83.52%
	JII	4.93%	67.72%	17.85%	0.18%	9.31%	100%	84.89%
	ISSI	0.07%	73.59%	16.84%	1.76%	7.72%	100%	80.09%
24	Gold	0.37%	3.64%	90.46%	5.21%	0.31%	100%	88.40%
	Oil	0.37%	2.96%	3.97%	89.45%	3.23%	100%	67.13%
	Bitcoin	0.00%	15.35%	1.03%	0.77%	82.83%	100%	74.18%

The Impulse Response Function provides an overview of how a variable will respond in the future if there is interference with another variable. To facilitate interpretation, the results of the analysis are presented in graphical form in Figure 2-3, for the 24 periods. In the pre-pandemic period (Figure 2), JII responded quite strongly to the shocks that occurred. However, this response quickly returns to equilibrium during the 6th period. Meanwhile, during a pandemic, JII responded strongly to the shocks that occurred, and it took longer to

reach the equilibrium point. In total, it took 24 periods for the JII and ISSI to return to equilibrium. During the Pandemic Covid-19, the impulse response function (Figure 3) shows that each variable responds strongly to the shocks that happened to itself. The ISSI took longer to return to equilibrium than the JII.

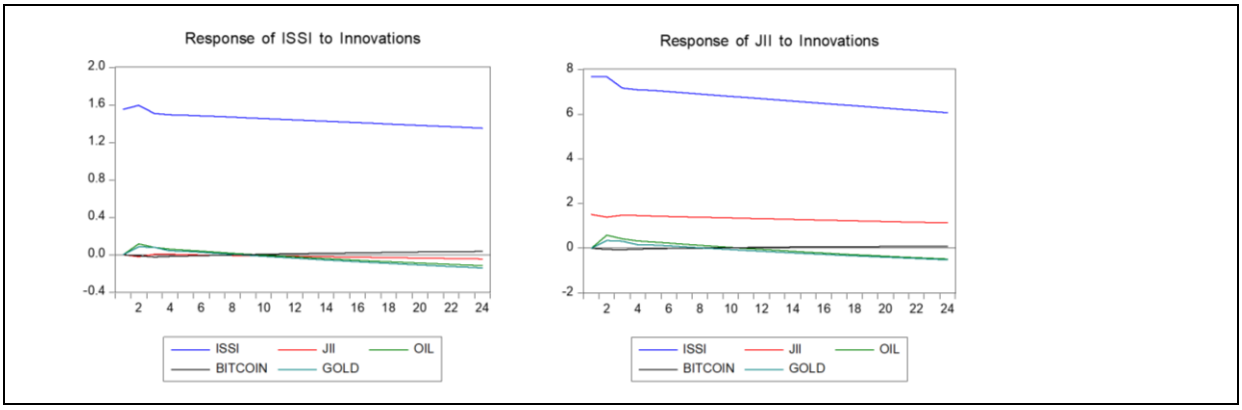


Figure 2: Impulse Responses in Pre-Covid 19 Pandemic

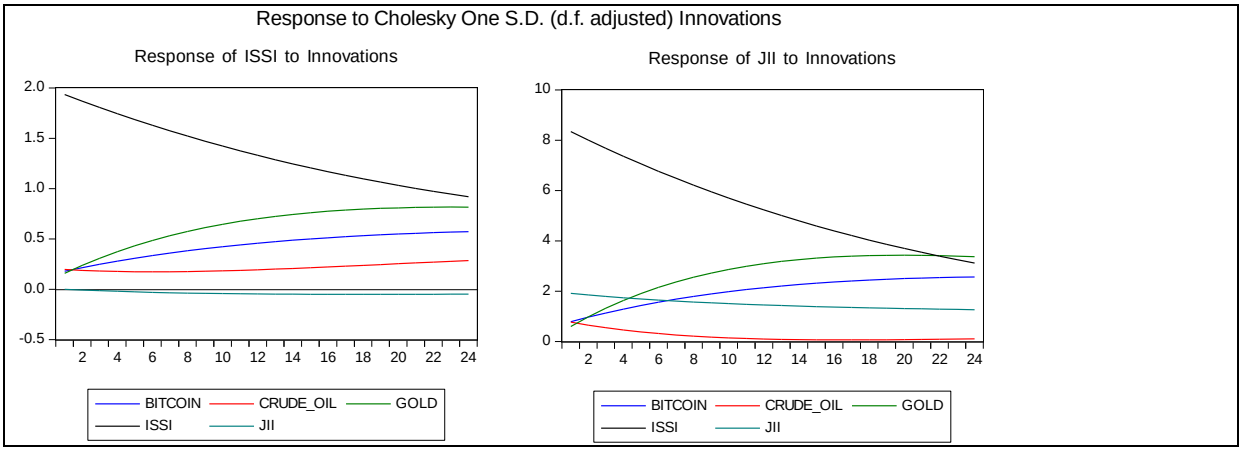


Figure 3: Impulse Responses during Covid 19 Pandemic

Conclusion and Recommendation

Modern Portfolio Theory asserts that investors should combine assets with a low correlation to construct an optimal portfolio with reduced risk. However, increased capital mobility and financial integration resulting from globalization and advancements in information technology have led to high correlations across asset classes. As a result, diversification strategies have become more challenging to implement, particularly in open economies such as Indonesia. The onset of the global pandemic in 2020 exacerbated this situation as there was a significant decline in stock prices, commodities, gold, and other important assets. Studies have demonstrated that both domestic and global crises lead to increased market integration. In light of the impressive performance of Sharia Stocks, this study examines the level of integration between the two Indonesian Islamic stock indices (JII and ISSI) and Gold, Oil, and Bitcoin, both before and during the pandemic.

The findings reveal full-ranked co-integration among the prices of the five assets, indicating that long-term integration is unlikely. VAR analysis shows that JII and ISSI are likely endogenous, while gold and Bitcoin are exogenous. The price of oil had a significant impact on the Sharia stock price index in Indonesia during both the pre-pandemic and pandemic

periods. However, during the pandemic, oil only exhibited a marginally significant influence on JII and ISSI, suggesting that oil and the two Sharia stocks may not act as diversifiers during this period. The results of the Variance Decomposition align with the VAR estimation, with oil playing a substantial role in explaining the variations in JII and ISSI. This implies that the Islamic Index tends to follow the movement pattern of oil in the event of shocks. Furthermore, the Granger causality test indicates a bidirectional relationship between oil and the two Islamic stock indices in both the pre-pandemic and pandemic periods. Therefore, investors must consider the price of oil when selecting stocks. Interestingly, Gold exhibits a low correlation with JII and ISSI during the pre-pandemic period, but shows a unidirectional relationship with the two stock indices during the pandemic. This suggests that gold serves as a good hedge under normal conditions, but fails to act as a safe haven during the pandemic.

On the other hand, Bitcoin has gained increasing attractiveness among investors since its legalization by Indonesian authorities in 2020. The results indicate a weak correlation between Bitcoin and the Islamic indices. The exogenous nature of Bitcoin suggests that it can be utilized as a diversifier or safe-haven instrument to mitigate Sharia stock losses. However, it is crucial to note that because of the high volatility and speculative elements of Bitcoin, it is recommended for short-rather than long-term investments. Because a diversifier is an asset that diversifies risk rather than insuring against reduced risk, the optimal weight of Bitcoin in a portfolio should be carefully determined. Conversely, the findings suggest that gold is not worthy of consideration as a diversifier in a portfolio, especially during times of crisis. Given the sensitivity of stock prices to oil price fluctuations, financial markets should exercise caution when disseminating information. Asymmetric information can amplify investor sentiment and lead to overreactions, which may impact market efficiency. These insights are valuable for maintaining the stability of the Sharia stock performance.

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