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Examinating The Effect of Covid-19 on The Efficient Market Hypothesis (EMH) Anomaly of The Islamic Stock Index in Indonesia

Purwanto Widodo[1]

Abstract. *This study aims to determine whether Covid-19 affects the return pattern of the Jakarta Islamic Index (JII) and whether the JII return is efficient in accordance with the Efficient Market Hypothesis (EMH). To ensure that the data analysis was in accordance with the objectives, samples were taken from January 1, 2008, to June 28, 2024, with ARCH-GARCH analysis so that the results were consistent and not robust. The findings of this research are as follows: JII returns are efficient because there is no Covid-19 effect and EMH anomaly, where there is no evidence of the day-of-the-week effect, Monday Effect, Friday Effect, or week four effect. In addition, the appropriate model is asymmetric EGARCH (1,1) with non-normal error term distribution. These findings have implications for investors, policy makers, and researchers interested in the performance and behavior of the Islamic stock market, so that in analyzing the stock market more strengthen the fundamental analysis of the company.*

Keywords: *Stock Efficiency; Day-of-the-Week Effect; Islamic Stocks; Covid-19*

Abstrak. *Penelitian ini bertujuan mengetahui Covid-19 mempengaruhi pola return Jakarta Islamic Index (JII) dan apakah return JII efisien sesuai dengan Efficient Market Hypothesis (EMH). Untuk menjamin bahwa analisis data sesuai dengan tujuan, maka diambil sampel mulai dari 1 January 2008 sampai dengan 28 Juni, 2024 dengan analisis ARCH-GARCH agar hasilnya konsisten serta tidak robust. Temuan penelitian ini adalah: return JII efisien karena tidak diketemukan adanya pengaruh Covid-19 serta anomaly EMH, dimana tidak terbukti adanya the day-of-the-week effect, Monday Effect, Friday Effect dan week four effect. Selain itu, model yang sesuai adalah asymmetric EGARCH (1,1) dengan distribusi error term non normal. Temuan ini memiliki implikasi bagi investor, pembuat kebijakan, dan peneliti yang tertarik dengan kinerja dan perilaku pasar saham syariah, agar dalam menganalisis pasar saham lebih memperkuat analisis fundamental perusahaan.*

Kata kunci: *Efisiensi Saham; the Day-of-the-Week Effect; Saham Syariah; Covid-19*

[1]Universitas Pembangunan Nasional Veteran (UPNV) Jakarta
E-mail: purwanto.widodo@upnvj.ac.id

Introduction

The Islamic stock index statistically measures the price movement of selected Islamic stocks based on the criteria set by the Indonesian Ulema Council (MUI) and the Financial Services Authority (OJK) through the Sharia Securities List (DES). According to the MUI fatwa, the IDX selects stocks that adhere to Sharia principles (IDX, 2023). Sharia stocks are the shares of companies compliant with Sharia principles in their operations (Susiati and Rahmawati, 2020). The DSN-MUI issued 17 fatwas, which the IDX uses to classify stocks as Sharia stocks (IDX, 2023). The MUI fatwa states that the Islamic stock market is efficient, with stock price movements influenced only by relevant information and not by return patterns or macroeconomic factors (Susiati and Rahmawati, 2020). Thus, during crises like the COVID-19 pandemic, Islamic stock return patterns remain stable (Nomran & Haron, 2021; Widodo, 2022; 2024). Rejeb and Arfaoui (2018), based on their research, stated that there is a tendency for the Islamic stock index to be more efficient than the conventional index, as market participants in the Islamic stock market integrate information more effectively, resulting in higher efficiency. Research conducted by Badri (2023) confirmed this. Based on research on the JII and FTSE Bursa Malaysia Hijrah Syariah (FBMHS) returns, the period from January 2017 to December 2019 showed that the JII and FBMHS returns were efficient. Furthermore, Syed and Khan (2017), using the KSE-100 Index during the period 1991-2014, concluded that the sharia index is efficient. Research by Tukenmez, Saka, and Kizgin (2019) concluded that although the efficiency of the Islamic stock index varies in time, stock markets, and countries, there is a tendency for a more stable economic condition of the Sharia index more than conventional. Research by Hasan and Kayser (2019) also concluded that the Dhaka Stock Exchange (DSE) is efficient.

The research conducted by Widodo (2022) on JII returns for the period March 1, 2020 to April 30, 2022, to find out any changes in return patterns due to Covid-19, apparently showed that there was no change in return patterns due to Covid-19. This was confirmed by Cipto et al. l (2024) on JII returns for the period March 2, 2020, to February 20, 2022. Similarly, Susianti and Rahmawati's research (2020) found no change in JII return patterns before and during COVID-19.

However, research conducted by experts shows different results. Research by Dharmawan, Khairunnisa, and Kurnia (2020) using the JII daily return for the period 2015 - 2019 shows out that the Sharia stock index is inefficient because there is an Efficient Market Hypothesis (EMH) anomaly. Gharaibeh's research (2021) on stock index returns in the Gulf Cooperation Countries (GCC) stock markets

(Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Abu Dhabi and Dubai) gave the same result, namely the existence of EMH anomaly in the sharia stock index.

This research was conducted to address these gaps in order to obtain more comprehensive results. The first is the research period. This study starts from the post-US financial crisis in 2018 to the post-COVID-19 period in May 2024. Then the data is categorized as pre-COVID-19, pre-crisis, and during the COVID-19 and post-COVID-19 periods. It is expected that with the grouping of these periods, it can be analyzed whether there are differences in the efficiency of sharia stocks between the three periods. Second, the data analysis method used is different. Previous research by Nomran and Haroon (2021), Afrilianto and Daryanto (2019), Chaouchi and Dhao (2020), Dewi and Dewi (2022), and Sansa (2020) used linear regression models to test EMH anomalies on global stock exchanges. These models include dummy variables (Monday to Friday) to assess whether certain days have returns that are statistically different from zero using the Ordinary Least Squares (OLS) model. However, OLS has limitations such as correlated returns, abnormal residuals, heteroscedasticity, distortion due to outliers, and stationarity issues in time series data, which leads to skewed regression (Widodo, 2022). Another difference is the analysis of various distributions given the high frequency of daily return data.

Literature Review

In 1970, Eugene F. Fama asserted in The Journal of Finance that security prices fully reflect available information, implying that consecutive price changes (typically returns over consecutive periods) are independent and uninfluenced by previous periods. Spulbar et al. (2021) further noted that Fama's Efficient Market Hypothesis (EMH) was inspired by Kendall's 1953 random walk theory, which posits that stock price fluctuations are independent and follow the same probability distribution. Despite ongoing debate, EMH has significantly influenced financial experts' and investors' perspectives on capital markets, suggesting that intense competition ensures that stock prices reflect all relevant information, making prices fair for both less-informed and more-informed investors. Consequently, unexpected news affects stock price changes (Adam et al., 2023). However, behavioral finance research has recently highlighted deviations from the EMH (Akkuş, 2022).

Deviations from EMH predictions are termed EMH anomalies, which are often reversed or weakened (Hendrawati & Huzaimah, 2019). The prevalence of these anomalies indicates the stock market's level of information efficiency. Globally, stock markets, including Indonesia, exhibit various anomalies that differ by country.

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Market players frequently seek to exploit these inefficiencies for abnormal returns. One extensively researched anomaly is the day-of-the-week effect, which contributes significantly to understanding market inefficiency and conditions (Sahu, 2023). According to the EMH, returns on securities should be consistent from Monday to Friday, but empirical evidence shows significant return differences between Monday and other days (Luxianto & Prasetyo, 2020; Dutta & Das, 2021). The day-of-the-week effect indicates that stock prices fluctuate within a week, with negative returns generally on Mondays (Monday effect) and positive returns on Fridays (weekend effect) (Iswadi et al., 2022; Riyani et al., 2022).

The Week-Four Effect indicates that the Monday Effect is present only in the fourth or fifth week of each month, while returns on Mondays in the first three weeks are not significantly negative or neutral. Musthafa and Soritaon (2019) highlight that this phenomenon was first identified by Wang et al. (1997). The Week-Four Effect tests the occurrence of negative Monday returns, specifically in later weeks. According to Musthafa and Soritaon (2019), Cahyaningdyah and Faidah (2017) findings demonstrate a significant return difference between Mondays and other weekdays, which is attributed to selling pressure. High selling activity on Mondays, primarily by individual investors reacting to unfavorable information from the previous Friday, drives negative returns. Mazviona, et al (2022) assert that weekly variations in daily stock returns are influenced by psychological factors affecting investor behavior, with a noted decline in investor mood from Monday to Friday.

Dharmawan, et al (2020) researched the Day of the Week Effect in the Indonesian Sharia stock market (JII) using daily data from 2015-2019. They found that the average returns were negative on Mondays and highest on Thursdays, but no significant day-of-the-week effect was observed. Rahim and Berlian (2020) analyzed daily JII returns from June 2018 to May 2019, identifying a day-of-the-week anomaly, indicating market inefficiency. Their findings show a significantly negative Monday effect and a positive, significant Friday effect on JII returns, suggesting that investors consider market trends before making decisions.

Research on conventional stock indices has yielded mixed outcomes. Afrilianto and Daryanto (2019) analyzed daily stock data from companies listed on the LQ45 index (2013-2018) using multiple linear regression, uncovering that Monday returns are significantly negative, while Wednesday returns are highest. Bagaskara and Kharunnisa (2019) employed mean difference analysis on the LQ45 index (2013-2017) and found that the highest average return on Mondays was positive. They concluded that a day-of-the-week effect exists, although neither a January

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effect nor a week-four effect was evident. Hendrawati and Huzaimah (2019) also used the LQ45 index with multiple linear regression, confirming a Monday Effect but not a weekend or January Effect. Wakhidah and Rafik (2019) applied the ARCH-GARCH volatility model to the IHSG and sectoral indices (2001-2016), identifying a day-of-the-week effect across 11 sectoral indices on the BEI. Prastiana, Handini, and Mas (2021) investigated the LQ45 Index (August 2020 – January 2021) and concluded there is both a Monday Effect and a Weekend Effect.

Research in other countries utilizing conventional, Sharia, or sectoral stock indices yields mixed results. Mazviona, Mah, and Choga (2022), examining sectoral stock indices in South Africa from 1995 to 2018 with an ARCH-GARCH volatility model, found a day-of-the-week effect, with a positive Monday average across all sectors. This finding suggests that investors act on weekly report information over the weekend, creating pressure on securities and boosting Monday returns (Zhang, Lai, and Lin, 2017). Sahu (2023), analyzing daily returns of the BSE Sensex in India from April 2013 to March 2016 with an ARCH-GARCH volatility model, also found a day-of-the-week effect, with positive returns from Monday to Friday. Similarly, Chaouachi and Dhaou (2020) examined the Canadian stock market from September 2009 to August 2019.

The results indicate that Monday's average return is negative, whereas Friday's returns are positive, with the highest return on Tuesday. Multiple linear regression was used for analysis. The research concluded the presence of a day-of-the-week effect and a Monday effect. Dash (2020) analyzed data from April 1, 2018, to March 31, 2019, on the National Stock Exchange (NSE) using the ARCH-GARCH volatility model, finding a day-of-the-week effect, albeit inconsistently across samples. Saxena, Puruhit, and Malhotra (2021) examined daily and weekly closing data from the Nifty Financial Services Index, Nifty Auto Index, Nifty Bank Index, and Nifty 50 Index for Indian equity markets from January 2011 to January 2018. Saxena identified a day-of-the-week effect in the studied sample through a multiple linear regression dummy variable analysis.

Sahoo (2021) analyzed daily closing data for Nifty 50, Nifty 50 Midcap, Nifty 100, Nifty 100 Midcap, Nifty 100 Smallcap, and Nifty 200 before and during the COVID-19 crisis. Using secondary data from April 1, 2005, to May 14, 2020, the study divided this period into pre-COVID-19 and COVID-19 subperiods. The results indicated negative Monday returns during the COVID-19 pandemic, contrasting with positive returns before the pandemic. Shariff and Yusof (2021) studied the Kuala Lumpur Composite Index (KLCI) from January 2015 to December 31, 2018, using the ARCH-GARCH model and found no day-of-the-

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week effects. Khasawneh (2022) examined the Amman Stock Exchange (ASE) from January 2, 2008, to December 31, 2019, concluding that local investors influenced the day-of-the-week effect. Their research shows that institutional investors are the primary source of ASE instability, with individual investors following institutional activities.

Individual investors make investment decisions based on their risk and capital gain. Enaizeh and Al Kilani (2022), analyzing Amman Stock Exchange 100 daily data from 2011 to 2019 via multiple linear regression, found that the day-of-the-week effect was significant, with the highest average daily returns on Thursday and Wednesday. Bolek, Szymańska and Lyroudi (2023), examining the OMX Baltic All-share index from January 1, 2009, to February 15, 2021, categorized the sample into pre-COVID (January 2009-January 2020) and during COVID (February 2020-February 2021). Using multiple linear regression, they concluded that the Baltic market was efficient pre-COVID but lost efficiency during the pandemic. Conversely, the Danish market was inefficient before the pandemic but efficient during COVID-19. Other OMX markets remained inefficient, with only some anomalies on specific days.

Adam, Yacob and Musa (2023) analyzed ten Islamic stock markets over a 20-year span from September 25, 2000, to September 24, 2020, using the ARCH-GARCH volatility model. The study found that the day of the week significantly influenced returns in the Islamic stock markets of DJIM, Indonesia, and Pakistan. Theory suggests that Monday's effect arises because it follows Friday's trend; thus, market increases on Friday often extend into Monday and vice versa. This "weekend effect" is linked to factors such as short selling, companies releasing negative news on Friday evenings, and reduced market confidence over the weekend (Adam, Yacob and Musa 2023). Güneş (2021) examined the Katilim 30 and Borsa Istanbul 100 Sharia stock indices, representing Turkey's conventional stock index, from January 2011 to July 24, 2020. The study concluded that no day-of-the-week effect was found, with the EGARCH (1,1) model being the most appropriate, indicating that negative information shocks increase volatility more than positive information shocks.

Pandey's research (2022) examined the Egyptian Stock Exchange from 2012-2019, revealing a day-of-the-week effect and confirming volatility clustering, with negative shocks generating more volatility than positive ones. Pandey (2022) attributes the negative average returns on Mondays to the lack of analyst reports, limited institutional trading, higher selling pressure for reserves, and a pattern of negative earnings announcements on Fridays. Gharaibeh's research (2021) on

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GCC stock markets (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Abu Dhabi, and Dubai) from 2012-2017 shows diverse results across different markets. This suggests that the varying outcomes regarding the EMH anomaly are due to differing liquidity levels and the varying evolution of the GCC markets from inefficient to efficient at different rates.

Extreme events like the global financial crisis (GFC) have significantly impacted financial sector development. For instance, the COVID-19 pandemic has led to severe lockdowns worldwide, affecting all economic sectors, including the financial system (Batool et al., 2020). Spulbar et al., (2020) note that global financial liberalization has had a lesser impact on developing countries compared to developed ones. Therefore, a theoretical framework that provides efficient solutions during financial turmoil is crucial.

Nomran and Haron (2021) compared the effects of COVID-19 on Islamic and conventional stock markets and found that they were unaffected by the pandemic. Komariah and Ramadhan (2022), using the daily returns of LQ 45, Nikkei, and DJIA from January 2019 to December 2021, found no differences in daily return patterns before, during, and after COVID-19. Wiratni et al. (2021) analyzed the Monday and weekend effects on IDX-30 and concluded that these effects existed both before and during the pandemic. Widodo (2024) examined LQ45 daily returns from 2008 to 2020 and found no significant differences in daily return patterns before and during COVID-19, although he identified a week-four effect and no Monday or weekend effects.

Sansa (2020) investigated the impact of COVID-19 on the financial markets of the USA and China from March 1 to March 25, 2020, and found a significant positive relationship between confirmed COVID-19 cases and the Shanghai Stock Exchange and New York Dow Jones indices. Tilică (2021) examined the impact of the Global Financial Crisis (GFC) on market efficiency in Poland, Romania, and Russia using data from January 1, 2000, to December 30, 2019. The study revealed the varying effects of the GFC on different indices, with the DOW effect observed in Poland's financial sector and Russia's chemical, telecommunications, transport, and energy sectors, showing positive coefficients on Mondays and negative coefficients on other weekdays. In contrast, Poland's IT and oil and gas sectors and Romania's energy sector exhibited a shifted DOW effect, with positive coefficients on Wednesdays, Fridays, and Tuesdays. The DOW effect leaves Poland's food and Romania's financial sectors unaffected. Tran (2022) analyzed the day-of-the-week effect on the Vietnamese stock market from 2014 to 2021 using multiple linear regression with dummy variables and found significant effects, particularly on

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Mondays and Fridays. Apart from that, there is no evidence to show that there has been a change in daily return patterns either before Covid-19 or during Covid-19.

Methods

This study uses daily stock return data from the Jakarta Islamic Index (JII), which is the first sharia stock index in Indonesia, starting on January 1, 2008, and ending on June 28, 2024, and then grouped into: All from January 1 to June 28 2024, Before Covid-19: January 1, 2008 until March 1, 2020; March 2, 2020, to June 21, 2023; and after, June 22, 2023, and June 28, 2024. JII daily stock data were obtained from Yahoo Finance.

Financial data often trend at levels with large fluctuations, and thus, it is not reasonable to draw valid conclusions. Therefore, the author carried out a log transformation to reduce fluctuations and differences that will create a mean reversion so that the JII daily return calculation uses the method used by Widodo (2022).

$$RJII_t = ln\left(\frac{JII_t}{JII_{t-1}}\right) \quad (1)$$

Where JII_t is the daily Jakarta Islamic Index in period t and JII_{t-1} is the index of the previous period.

Model I for estimating the day-of-the-week effect

$$RJII_t = \beta_o + \beta_1 Mon_t + \beta_2 Tues_t + \beta_3 Wed_t + \beta_4 Thurs_t + \sum_{i=1}^{p} \gamma_i \, RJII_{t-i} + \varepsilon_i \quad (2)$$

Where Mont, Tuest, Wedt, and Thurst are dummy variables for Monday, Tuesday, Wednesday, and Thursday, respectively. Where $\sum_{i=1}^{p} \gamma_i \, RJII_{t-i}$ are the lag values of the return variable. It was included in the equation to eliminate the possibility of autocorrelated errors and heteroscedasticity problems) (Nur & Dewangkara, 2020).

The day-of-the-week effect can be seen from whether the difference in returns from Monday to Friday or the regression coefficient is not equal to zero (Luxianto & Prasetyo, 2020). The Monday Effect is detected if the regression coefficient on Monday is significantly negative, while the other days are positive.

Model 2 for estimating Week Four Effects

$$RJII_t = \beta_o + \beta_1 Monw1_t + \beta_2 Monw2_t + \beta_3 Monw3_t + \beta_4 Monw4_t + \beta_5 Covid_t + \sum_{i=1}^{p} \gamma_i \, RJII_{t-i} + \varepsilon_i \quad (3)$$

Where Monw1t, Monw2t, Monw3t, and Monw4t are dummy variables for Monday Week1, Monday Week2, Monday Week3 and Monday Week4. The existence of Week Four Effect: if the regression coefficient on Monday of the first week, Monday of the second week, and Monday of the third week is negative, it is not significant,

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while Monday of the fourth week and Monday of the fifth week are negative and significant.

The author followed Widodo's (2022; 2024) methodology, which included the following:

First, data were grouped into all categories: before, during, and after Covid-19.

Second, stationarity testing was performed on each data group to ensure a constant mean, variance, and covariance over time (Widarjono, 2018). This involves Augmented Dickey-Fuller (ADF) and Phillips–Perron (PP) tests.

Third, Box Jenkins modelling was applied. If the data are stationary at level I(0), ARMA is used; if they are stationary at the first difference I(1), ARIMA is employed. A fit ARIMA/ARMA model requires significant AR and/or MA coefficients and no white noise, tested using the Box and Pierce Test or Q Test (Widodo, 2022). Additionally, the significance of the COVID-19 dummy variable was tested by grouping samples accordingly.

Fourth, after confirming the white noise of the ARMA/ARIMA model, volatility clustering is tested using the ARCH test (Brooks, 2019). Significant ARCH effects indicate the need for volatility models such as ARCH, GARCH, EGARCH, Threshold GARCH, and PARCH (Nur & Dewangkara, 2020). The fit volatility model showed nonsignificant ARCH tests and white noise.

Fifth step. The fit of the volatility model was then tested to determine whether asymmetry exists in volatility. In this test, the author used a model developed by Engle and Ng (1993) (Brooks, 2019):

$$\hat{u}_t^2 = \phi_o + \phi_1 S_{t-1}^- + \phi_2 S_{t-1}^- \mu_{t-1} + \phi_3 S_{t-1}^+ \mu_{t-1} + v_t \quad (4)$$

The significance of ϕ_1 indicates that there is a sign bias, meaning that if an economic shock occurs that has a positive or negative effect on JII returns, it has a different impact on future volatility, compared to the symmetric response required by the standard GARCH formulation. On the other hand, the significance ϕ_2 atau ϕ_3 indicates the presence of a size bias, where not only the sign but also the magnitude of the shock is important. The combined test statistic is formulated in a standard way by calculating TR2 from regression equation (5), which asymptotically follows a $\chi 2$ distribution with three degrees of freedom under the null hypothesis of no asymmetric effects.

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Results and Discussion

Time-series data often have averages and variances that are not constant over time, making it difficult to make predictions (Widarjono, 2018). To overcome this problem, a stationarity test is conducted. The result is:

Table 1. JII Stationarity Return Test

	ADF Test		Phillips-Perron test	
Sampel	**t-Statistic**	**Prob.***	**Adj. t-Stat**	**Prob.***
All	-61.1708	0.0001***)	-61.1404	0.0001***)
Before	-50.9700	0.0001***)	-50.8655	0.0001***)
During	-23.2885	0.0000***)	-29.6778	0.0000***)
After	-18.3448	0.0000***)	-18.4203	0.0000***)

Note: ***) significant at level 1%

Table 1 shows that, for all samples, the probability of the ADF and Phillips–Perron tests is significant at the 1% level, so it is concluded that it is stationary at the level or I(0).

Meanwhile, the sample average is:

Table 2. Descriptive Statistics of JII Return Trading

	Fri	**Mon**	**Thu**	**Tue**	**Wed**
All	0.0006	-0.0016	-0.0002	0.0002	0.0010
After	-0.0002	-0.0012	0.0001	0.0007	-0.0012
Before	0.0004	-0.0015	-0.0003	0.0002	0.0015
During	0.0015	-0.0020	0.0003	0.0001	-0.0003

Table 2 shows that the JII's average daily return for Fridays is inconsistent. For After Covid-19 the average was negative, while the others were positive. The Monday average is negative for All and Before samples, the Tuesday average, All, and Before samples are negative, while the others are positive, Tuesday is consistently positive, and Wednesday after and During Covid-19 are negative.

Once it is known that the JII's daily return is stationary at level, the next step is to model it using the Covid-19 dummy variable. Box Jenkins is used as the initial model. A white noise test was performed to determine whether the model fit.

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Table 3. Model ARMA/ARIMA

Variable	Coefficient	Std. Error	t-Statistic	Prob.
S2	0.0001	0.0003	0.2127	0.8315
S3	-0.0001	0.0005	-0.1644	0.8694
AR(3)	-0.8324	0.0890	-9.3577	0.0000***)
AR(6)	-0.5413	0.0848	-6.3844	0.0000***)
AR(1)	0.0323	0.0075	4.3336	0.0000***)
MA(3)	0.8027	0.0896	8.9541	0.0000***)
MA(6)	0.4778	0.0859	5.5619	0.0000***)
MA(9)	-0.0811	0.0101	-8.072	0.0000***)

Note: ***) significant at level 1%

Table 3 shows that AR and MA are significant at the 1% level, while variable S2, which shows the dummy before Covid-19 and the S3 dummy during Covid-19 is not significant, indicating that Covid-19 has no effect on the daily return pattern of the JII stock index; therefore, for further data processing, all data are used by removing dummies S2 and S3 and entering trading day dummy variables (D1, D2, D3, and D4). The results show that COVID-19 has no effect on stock return patterns, which is in line with the research by Riyani et al. (2022), Nomran and Haron (2021), Komariah and Ramadhan (2022), Cipto et al. (2024)

Then, the model was tested for White Noise to ensure that it was fit. White noise was tested using the Box and Pierce Test or Q Test (Portmanteau Test) with a lag of 36 obtained a Q of 36,996, while the probability was 0.177. Because the probability value was greater than the significance level, it was concluded that the ARMA/ARIMA model contained white noise.

The ARMA/ARIMA model, which contains white noise, was used to determine whether there was an ARCH effect. The results of the ARCH effect test using the heteroskedasticity test (ARCH) showed that Obs*R-squared was equal to 445.0025, and Prob. The chi-square (2) was 0.0000. Because the probability is smaller than 1%, which means it is significant, it is concluded that there is an ARCH effect, so it needs to be modelled with the ARCH-GARCH volatility model.

ARCH-GARCH modelling is considered fit if there are no ARCH Effect problems and there is white noise. The LM Test results showed that Obs*R-squared was equal to 3.1435567 with a probability of 0.2077, which is not significant at the 5 percent level, while the Box and Pierce Test or Q Test (Portmanteau Test) with a lag of 36 on the Quadratic Residual Correlogram obtained a Q value of

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35.029 with a probability of 0.515. Thus, it was concluded that there was no ARCH Effect problem and that the model was fit.

The fit of the ARCH-GARCH model is then analyzed to determine whether there is a leverage effect, as Brooks (2019) recommended. Engle and Ng (1993) were used for leverage testing (Brooks, 2019). The result is:

Table 4. Engle and Ng Test Model 1

	t-Statistic	Prob.	
Sign-Bias	0.517349	0.6049	
Negative-Bias	-1.534589	0.1250	
Positive-Bias	-1.610196	0.1074	
Joint-Bias	12.350405	0.0063	***)

Note: ***) significant at 1% level, **) 5% level, *) 10% level

The Engle and Ng tests in Table 4 show that Φ_3 is significant, while negative bias and joint bias are not significant. These results indicate that there is a leverage effect problem. Because there is a leverage effect, it is modelled using an asymmetric model, namely EGARCH (1,1), TARCH (1,1), and PARCH (1,1). The most appropriate model analysis result was EGARCH (1,1).

Table 5. Analysis Results of Model 1 The Day-Of-The-Week Effect

Variable	Coefficient	Std. Error	z-Statistic	Prob.	
FRI	0.0002	0.0003	0.5730	0.5666	
MON	0.0001	0.0004	0.2885	0.7730	
TUE	-0.0001	0.0004	-0.1318	0.8951	
WED	0.0002	0.0004	0.4786	0.6322	
THU	-0.0003	0.0004	-0.8927	0.3720	
AR (26)	0.0427	0.0134	3.1787	0.0015	
MA (12)	0.0371	0.0156	2.3852	0.0171	
	Variance Equation				
C (8)	-0.3253	0.0252	-12.9126	0.0000	***)
C (9)	0.1756	0.0113	15.5193	0.0000	***)
C (10)	-0.0791	0.0069	-11.4099	0.0000	***)
C (11)	0.9791	0.0022	441.5857	0.0000	***)

Note: ***) significant at 1% level, **) 5% level, *) 10% level

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The results of the analysis of Model 1 in Table 5 show that the appropriate model is EGARH (1,1); however, the error term does not follow a normal distribution but rather a Generalized Error Distribution (GED). We can examine coefficient C (10) to observe the leverage effect. Coefficient C (10) shows a negative and significant sign; therefore, the existence of the leverage effect is confirmed (Brooks, 2019).

To test whether the day-of-the-week effect exists, we use the Wald Test, with the null hypothesis that FRI, MON, TUE, WED, and THU together are equal to zero. The Wald test results show that the F-statistic is equal to 0.588924 and the probability value of 0.6707; therefore, this research cannot prove the day-of-the-week effect phenomenon. These results are in line with those of Dharmawan, Khairunnisa & Kurnia (2020) using JII daily returns from 2015 to 2019.

The next test determines whether there is a Monday Effect. The Wald test results show that the regression coefficient is positive (0.0001) and not significant; therefore, it is concluded that there is no Monday effect on the JII return pattern.

The next test is to determine whether there is a weekend or Friday effect. The Wald test results prove the existence of the Weekend Effect. The analysis results show that the regression coefficient is 0.0002 but is not significant, so it can be concluded that the Weekend Effect is not found in the JII return pattern.

The descriptive statistics for testing Model II are as follows.

Table 6. Week Four Effect Descriptive Statistics

	Mon-Week1	**Mon-Week2**	**Mon-Week3**	**Mon-Week4**
Before	0,0004	-0,0003	0,0004	-0,0008
During	0,0039	-0,0007	-0,0011	0,0003
After	0,0010	-0,0003	0,0001	-0,0006

Table 6 shows that the average return on Monday-Week1 is consistent because it is positive in the period Before, during, and After COVID-19, while Monday-Week2 is consistently positive.

The white test results on the Jenkins Box model, with a lag of 36, obtained a Q of 39,142, while the probability was 0.09. Because the probability value was greater than the significance level, it was concluded that the ARMA/ARIMA model II had white noise.

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The next step is to test for an ARCH effect using the LM test. The LM test shows that Obs*R-squared is equal to 4225.0852 with a probability of 0.000; therefore, it is concluded that there is an ARCH effect problem. Then, the author carried out modelling with ARCH-GARCH (1,1) and tested again using the LM test to ensure that the ARCH Effect no longer existed. In the EGARCH (1,1) LM test residual squared model, the Q value is equal to 27.336 with a probability of 0.8500, and the Heteroskedasticity Test: ARCH obtains Obs*R-squared equal to 2.3486 and Prob. Chi-Square (2) 0.309, so it can be concluded that Model II does not have white noise or ARCH Effect problems. The author then confirmed the existence of an asymmetric information problem, as Brooks (2019) recommended. Engle and Ng (1993) (Brooks, 2019) were used to test asymmetric information. The result is:

Table 7. Engle and Ng Test Model II

	t-Statistic	**Prob.**	
Sign-Bias	1.663366	0.0963	*)
Negative-Bias	-1.15468	0.2483	
Positive-Bias	-0.96952	0.3323	
Joint-Bias	16.25377	0.0001	***)

Note: ***) significant at the 1% level, **) 5% level, *) 10% level

The Engle and Ng test in Table 7 shows a significant joint bias at the 1 percent level, meaning that there is a difference in response if there is good news and bad news, or in other words, there is a leverage effect problem. Because there is a leverage effect, it is modelled using an asymmetric model, namely EGARCH (1,1), TARCH (1,1), and PARCH (1,1). The result is:

Table 8. Results of Analysis of Model II The Week Four Effect

Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**	
MON-WEEK4	-0.0001	0.0002	-0.7924	0.4281	
MON-WEEK1	0.0029	0.0015	1.8860	0.0593	*)
MON-WEEK2	-0.0004	0.0006	-0.6888	0.4909	
MON-WEEK3	-0.0013	0.0008	-1.6356	0.1019	
AR(3)	0.7023	0.0850	8.2588	0.0000	***)
AR(16)	-0.1780	0.0563	-3.1627	0.0016	***)

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Variable	Coefficient	Std. Error	z-Statistic	Prob.	
MA(3)	-0.7504	0.0830	-9.0409	0.0000	***)
MA(9)	0.0425	0.0121	3.5089	0.0004	***)
MA(16)	0.1937	0.0551	3.5131	0.0004	***)
	Variance Equation				
C(10)	-0.2461	0.0171	-14.3680	0.0000	***)
C(11)	0.1506	0.0105	14.3472	0.0000	***)
C(12)	-0.0623	0.0068	-9.1722	0.0000	***)
C(13)	0.9850	0.0017	595.6174	0.0000	***)

Note: ***) significant at the 1% level, **) 5% level, *) 10% level

The results of the model II analysis in Table 8 show that the appropriate model is EGARH (1,1), with a normally distributed error term. To examine the leverage effect, we examine C (10). It can be seen in Table 7 that coefficient C (12) is negative and significant, so it can be concluded that the existence of the leverage effect is confirmed (Brooks, (2019)).

A week four effect is detected if the first Monday of the week is positive but insignificant, while the Mondays of other weeks are significant. The second and third-month results were both negative and statistically significant. Table 7 shows that what was expected from the week four effect was not fulfilled, so it was concluded that this research could not prove the existence of the Week Four Effect on the Sharia stock index.

Discussion of research results

Over the last two decades, Sharia markets have attracted the attention of national and international investors because of their specific characteristics and are limited by Sharia principles. These characteristics include funding arrangements that are specifically based on murabahah and musharakah mechanisms, which are expected to encourage economic development through the success of agreed projects. Islamic markets, more than conventional markets, have better performance (in terms of volatility and efficiency) and are able to finance economic growth effectively and healthily.

Sharia shares are securities in the form of shares that do not conflict with Sharia principles in the capital market, which refer to the general definition of shares as regulated in the OJK laws and regulations. All Sharia shares in the

Indonesian Sharia capital market are periodically included in the DES, which is the criterion for selecting Sharia shares by the OJK; namely, the issuer does not carry out business activities that are gambling in nature and are prohibited according to Sharia, non-usury financial services, buying and selling risks that contain elements of uncertainty (gharar); not produce, distribute, trade-in haram goods or services, goods/services that damage morals and/or are harmful, risky transactions, and the issuer meets an interest-based financial ratio compared to total assets of no more than 45% or total non-halal income of more than 10%. Sharia issuers or public companies are required to have a Sharia Supervisory Board (DPS). DPS members are required to have a Capital Market Sharia Expert (ASPM) permit from the OJK and must be appointed by the General Meeting of Shareholders (GMS) (Iswadi et al., 2022) (Habibi, Nomasyahuri and Anggraeni, 2022).

The results of this study show that COVID-19 does not affect the daily return patterns of the JII stock index. Research by Alam et al. (2020) on the Indian Stock Exchange concluded that the lockdown imposed by the government had a positive effect on stock market performance, so return patterns were not affected. Research by Susianti and Rahmawati (2020), Komariah and Ramadhan (2022), and Widodo (2024) revealed the same thing, namely that there was no difference in the pattern of daily stock returns in Indonesia before and during Covid-19. According to Komariah and Ramadhan (2022), the insignificance of COVID-19 on international stock movement patterns is the result of the US Senate's decision to approve a fiscal stimulus of $2 trillion. This stimulus will be distributed to the health sector, MSMEs, energy, and business world. Another positive aspect is the steps taken by Central Banks in several countries to imitate the Fed's lower interest rate policy. The US Central Bank has also added liquidity injections to the financial markets. These various steps are seen as commitments by the G20 countries to reduce investor panic in global financial markets. As a result, stocks in various countries have experienced strengthening, including Indonesia. One of the things that improved financial markets around the world, including Indonesia, was the US Senate's decision to approve a fiscal stimulus of $2 trillion. This stimulus will be distributed to the health sector, MSMEs, energy, and business world. Another positive aspect is the steps Central Banks took in several countries to imitate the Fed's lower interest rate policy. The US Central Bank has also added liquidity injections to the financial markets. These various steps are seen as commitments by the G20 countries to reduce investor panic in global financial markets. These efforts have strengthened stocks in various countries, including Indonesia.

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According to Habibi, Nomasyahuri and Anggraeni 2022, with reference to six behavioral indicators (media reporting, fake news, panic, sentiment, media sensation, and infodemic), Covid-19 has had a negative impact on the global Sharia capital market. The higher the number of Covid-19 outbreaks, the lower the capital market stock index in the world, including Indonesia. The number of deaths due to the Covid-19 outbreak has had an even greater impact. Furthermore, the government regulations can reduce these negative impacts.

This helps to reduce excessive price fluctuations on certain days or weeks. As a result, investors' enthusiasm in Indonesia has increased in carrying out stock buying and selling transactions. Meanwhile, Susianti and Rahmawati (2020) concluded that JII stock returns are efficient because they are not affected by COVID-19, and this identifies that the shares of companies that are members of JII have implemented apply sharia principles regulated in the MUI Fatwa CHAPTER V Article 5 concerning securities transactions and article 6 concerning fair prices.

This research also shows that the EMH anomaly phenomenon was not detected because the day of the week effect, Monday effect, weekend effect, and week four effect were not significant. In other words, the Indonesian Sharia index, specifically the JII, is efficient. This was in accordance with the results reported by Dharmawan, Khairunnisa and Kurnia (2020), Badri (2023), and Kusherawati and Fauziyah (2023). Riyani et al. (2022), using IHSG daily returns for 2018 – 2020, concluded that COVID-19 did not affect the IHSG daily return pattern and did not show EMH anomalies. According to Syarif (2019), government policies that have strict regulations and supervision of Sharia stock trading so that it is more transparent and fair can reduce excessive price fluctuations on certain days, weeks, or months. In accordance with Fama's (1976) statement, it shows that in an efficient market, stock prices already reflect all available information, both information originating from the macro economy and from company specifics. Furthermore, Cipto et al. (2024) said that Some factors caused no difference in stock returns before and after the announcement of COVID-19 in Indonesia, including the possibility that information regarding COVID-19 has leaked so that the market responds appropriately to information regarding circulating announcements. IDX Syariah states that the stocks that are grouped into sharia stocks are: a). Sector Diversity: The Indonesian Sharia Index covers various industrial sectors with different business cycle characteristics. This can reduce the influence of seasonal or psychological factors that may affect the day of the week. b) Strict Regulation: Strict regulations in the Indonesian capital market help to reduce the chances of stock price manipulation that may cause anomalies such as the day-of-the-week

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effect and c) Effectiveness of Market Mechanisms: Efficient market mechanisms, such as the existence of market makers and trading algorithms, help keep stock prices reflective of their intrinsic value.

The findings of this research are consistent with portfolio theory, which states that investors' choice of investment strategy is influenced by risk estimates and return expectations, which are measured statistically to build their investment portfolio. Consequently, investors prefer to place their funds in the Islamic stock market with promising short-term prospects. In particular, during the Covid-19 period which brought economic shocks in the investment sector to shocks between one stock market and another, it is important to consider the short-term and long-term effects of the dynamics of the Islamic stock index between one stock market and another. Sharia capital markets with other Sharia capital markets, so investors need to pay close attention to developments in Sharia markets in other countries (Habibi, Nomasyahuri and Anggraeni 2022). According to Badri (2023), this is due to the caution of investors in both Indonesia and Malaysia in responding to COVID-19, so they tend to exercise restraint in carrying out stock trading activities.

Conclusion

This study examines the efficiency of the Islamic stock index in Indonesia, represented by the Jakarta Islamic Index (JII), and the impact of the Covid-19 pandemic on return patterns. This research utilizes daily return data from periods before and after the pandemic, applying a volatility model to mitigate potential biases. The findings reveal that government policies in response to the crisis had a minimal impact on the JII return movement, and the most suitable model was EGARCH with a non-normal distribution. Furthermore, the study concludes that stocks in the Sharia group exhibit efficiency, as no day-of-the-week, Monday, Friday, or week-four effects were observed.

For investors, JII returns include weak-form efficiency, which indicates that previous returns cannot be used to predict current returns. As a result, the technical analysis instruments used to predict stock prices and provide signals to buy, hold, or sell are useless. On the other hand, if not proven, investors can make predictions using techniques or tools that use time-series analysis techniques.

This research's limitation is that it only uses daily stock return variables and does not include control variables such as macroeconomics. Subsequently, the research period began. The crisis period was from March 1, 2020, to June 28, 2024. However, some parts of Indonesia no longer implement WFH.

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