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Volatility Spillovers and Comparative Analysis of Conventional and Islamic Equity Markets During Global Financial Crisis and Covid-19 Pandemic: Empirical Evidence from Malaysia

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ABSTRACT

This study investigates the co-movement and integration between conventional and Islamic indexes in Malaysia by analysing the volatility spillover and asymmetric effect over the period of 28/2/2007 to 28/2/2023. The sample is divided into five periods: full sample period, pre-, during- and post-Global Financial Crisis period including the during-COVID-19 period. Based on GARCH-M and EGARCH models, the findings indicate that the volatility of every index is more responsive to its lag values than it is to new shocks with the Islamic index consistently demonstrating higher volatility persistence than its conventional counterpart. The EGARCH results also observe asymmetric bidirectional volatility spillovers between Malaysia's conventional and Islamic index in the during-GFC period. However, unidirectional volatility spillover is found in every sample period, except for the during-COVID-19. This indicates the absence of return and volatility spillover, which makes COVID-19 a special/unique event for Malaysia. The overall findings support the decoupling hypothesis for Malaysian conventional and Islamic indexes. Hence, it is important for policymakers in developing policies to deal with the co-movement and spillovers of the indexes for achieving financial stability. This study suggests that domestic investors in Malaysia have high diversification opportunities by combining both conventional and Islamic indexes in their portfolios in the long run.

JEL Classification: G11

Keywords: Islamic index; Co-movement; GARCH-M; EGARCH; Decoupling hypothesis

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INTRODUCTION

In recent years, Islamic equities have garnered significant attention from academic researchers, policymakers, and investors, particularly in the wake of the global financial crisis (GFC) of 2007/08 and the COVID-19 pandemic. COVID-19 has led to real economic shrinkage, altered livelihoods, and increased global co-movements. It was reported that four circuit-breaker events occurred in the US market in March 2020 alone, with international markets also faced increased volatility (Contessi and De Pace, 2021). Although COVID-19 initially emerged as a health crisis, it swiftly evolved into a financial and economic disaster on par with the 2008 GFC (Goodell, 2020). During the COVID-19 crisis, countries worldwide enacted monetary and fiscal stimulus measures, such as mandatory lockdowns and social distancing (Baig et al., 2021). The Islamic index has been used as a safe haven during several crises, making it crucial to understand the volatility characteristics and volatility spillovers of Islamic and conventional indexes. According to recent data, the total value of Islamic finance assets was US$4.00 trillion in 2021, with projections estimating it will grow to US$5.90 trillion by 2026 (Islamic Financial Services Board, 2022).

It's important to highlight that Islamic finance has attracted significant interest from non-Muslim investors and has emerged as a crucial tool for portfolio diversification. (Nurhayati et al., 2021; Saiti et al., 2022). Islamic finance instruments adhere to Islamic law, or Shariah, which establishes a framework of ethical and financial restrictions for Shariah screening, including profit and loss sharing. Shariah laws oversee Islamic assets, prohibiting activities such as gambling, interest-bearing transactions, and high-risk business practices, including arbitration, short-selling and speculation (Bhutto et al., 2021; Foo et al., 2023; Kamaludin and Zakaria, 2019; Sundarasen et al., 2022). Due to the prohibition of interest, the lack of risk transfer, and the principles of profit and risk sharing that underpin Shariah-compliant assets, it is anticipated that Islamic financial products may, in theory, be more resilient in withstanding financial crises (Hasan, et al., 2021).

Earlier studies have shown inconclusive findings in the dynamics between conventional and Islamic indexes. On the one hand, more recent empirical investigations validate the decoupling hypothesis, concluding that Islamic indexes could serve as a safe haven in times of crisis (Alahouel and Loukil, 2021; Alqaralleh and Abuhowmmous, 2021; Haroon et al., 2021; Mandaci and Cagli, 2021; Shahzad and Naifar, 2022). On the other hand, other studies oppose the decoupling hypothesis, showing evidence that Islamic indexes did not consistently exhibit the characteristics of safe havens during times of distress (Anas et al., 2020; Bugan et al., 2022; Hassan et al., 2020). The decoupling hypothesis suggests that Islamic stocks have distinct risk and return characteristics compared to conventional stocks, providing investors with a unique opportunity for diversification. (Usman et al., 2019).The pressing demand for assets with safe-haven characteristics has intensified during COVID-19, similar to the situation during the GFC. (Goodell, 2020). Yarovaya et al. (2020) claimed that investors suffered huge losses due to a lack of understanding regarding the behaviour of safe-haven instruments. Recent studies, such as those by Yarovaya et al. (2021) and Hasan et al. (2021), investigate the resilience of different assets with safe-haven characteristics. The authors found that traditional assets, especially during the COVID-19 pandemic, failed to function as safe havens. In contrast, these assets were effective during the GFC. Their findings support the notion that the economic contagion caused by the COVID-19 pandemic differs from those associated with the Great Depression, the GFC, or previous pandemics (Contessi and De Pace, 2021). The equity markets' reactions to safe havens may vary because the underlying causes of previous crises differ from those of the COVID-19 pandemic (Disli et al., 2021). The GFC was mainly fueled by reckless accounting fraud, lending practices, inadequate risk management and excessive leveraging of subprime mortgage instruments. However, Islamic finance was less impacted by the GFC due to Shariah laws prohibiting many of the practices involved (Hassan et al., 2020). As a result, the COVID-19 pandemic is expected to have a reduced effect on Islamic assets, potentially offering investors a degree of protection during the crisis. However, the significant economic disruptions caused by the pandemic have raised concerns about the sustainability of Shariah-compliant assets. Therefore, it is essential to evaluate how the financial market responds to this unprecedented COVID-19 crisis and to compare it with the GFC.

This study aims to explore and compare various aspects of volatility, including volatility behaviors, spillovers, and asymmetric effects, as well as cointegration and market efficiency between the Islamic equity index and its conventional counterpart. The study is organized as follows: Section two reviews relevant literature, followed by a discussion of data and methodology. Section four presents the analysis of the findings, with Section five offering the concluding remarks.

RELATED LITERATURE REVIEW

Theoretically, there are two important fundamental understandings regarding volatility, spillover, and risk-return trade-off between Islamic and conventional stock markets: decoupling and contagion theories. The theories address the most debatable notions of whether the indexes offered by the Islamic financial market are "safe-haven" for investors and also whether these indexes provide diversification opportunities to conventional investors, particularly during predicament periods of crises.

Extant evidence in the literature has highlighted the influence of the COVID-19 pandemic on volatility and risk-return trade-off in equity markets (Balli et al., 2022; Foo et al., 2023; Mzoughi et al., 2022)**.** Several studies support the decoupling theory, concluding that Islamic indexes can provide risk-hedging benefits for investors in the conventional financial market. Shahzad and Naifar (2022) claimed that Islamic equities may fulfil the risk tolerance of investors during financial crises and thus served as alternative investment vehicles to conventional ones. The strand of literature pointed out that Shariah-compliant stocks are experiencing notable growth in international portfolio diversification, providing 'safe-haven' advantages and hedging. (Akbari and Ng, 2020; Bossman et al., 2022) particularly during turbulent periods. These findings confirmed that the decoupling exists between conventional and Islamic financial markets. Likewise, a study by Adekoya et al. (2022) indicates a strong integration and a high spillover status between the Islamic index and conventional index from January 1, 2020, to 30 November 2020 in nine different sectors in the US, China, Nigeria, and Saudi Arabia. They also found that Islamic equity indexes generally are more immune to shocks, stable, and have less exposure to risks compared to conventional indexes. The findings sit alongside Karim et al. (2022), stating that the returns for Islamic indexes are less vulnerable to market panic than their counterparts in conventional indexes. The authors claimed that this is due to the unique screening that provides the Islamic index being more decoupled than the conventional index.

A more recent study by Bugan et al. (2022) contends that the Islamic index offers limited diversification benefits during the COVID-19 crisis, thereby reducing its effectiveness as a safe haven during turbulent times. Similarly, several studies (see Hassan et al., 2020; Hasan et al., 2021; Jawadi et al., 2021) show that Islamic and conventional markets exhibit strong co-movement, particularly during the COVID-19 period. These findings challenge the decoupling hypothesis, suggesting that Shariah screening procedures may not be sufficient to endow Islamic assets with safe-haven characteristics during periods of market distress. The contagion hypothesis aids financial communities in assessing the diversification benefits of incorporating Islamic financial assets into their portfolios. Balli et al. (2019), in their study spanning 2007 to 2017, discovered increasing correlations in returns and volatility spillovers among 15 Islamic stocks. This finding underscores the asymmetrical nature of spillovers between Islamic and conventional markets. The authors also noted that during crises, cumulative spillovers among Islamic markets tend to be more concentrated. Haddad et al. (2020) explored the impact of shocks on the fluctuations in the business cycle of the Dow Jones Islamic stock market (DJIM), covering regions such as the US, UK, Canada, Europe, Asia-Pacific, Japan, and the GCC from April 2003 to November 2018. Their evidence indicates that the DJIM US, UK, Europe, and GCC indexes are more sensitive to both domestic and international shocks, whereas the DJIM Canada, Asia-Pacific, and Japan are more inclined to domestic shocks. They highlighted that spillover volatility is predominantly transmitted by the DJIM US and received by the DJIM GCC during crises. In another study, Haroon et al. (2021) found that Islamic equities exhibited lower systematic risks during the COVID-19 period, offering diversification advantages to investors. This lower systematic risk could be attributed to Shariah screening procedures that emphasize a lower level of debt. In a more recent study, Owusu Junior and Owusu (2022) argued that spillovers between assets increased during crises, such as the COVID-19 pandemic, partly due to persistent efforts by rational and irrational market participants to minimize risks and maximize returns. These actions led to disorderly asset trading, resulting in unforeseen non-fundamental interconnectedness among the assets (Bossman, 2021).

Mountains evidence in the literature have employed the GARCH model and its variants to build a volatility framework in finance and economics. The GARCH family models have demonstrated their effectiveness in capturing persistence, volatility clustering, and asymmetric effects (see Abduh, 2020; Hossain et al., 2021; Yong et al., 2021; Akinlaso et al., 2021; Danila et al., 2021; Arashi and Rounghi, 2022; and Kaur and Singla, 2022). Abduh (2020) employed the GARCH (1,1) model to analyze the volatility of conventional and Islamic equity indexes in Malaysia from 2008 to 2014, concluding that the Islamic index was less volatile during the GFC due to a higher proportion of defensive stocks and fewer conventional financial institution stocks. In Tunisia, Akinlaso et al. (2021) discovered a significant negative risk-return trade-off in the conventional index but not in the Islamic index, using both symmetric and asymmetric GARCH models. They also found a positive leverage effect in the Islamic index and a negative leverage effect in the conventional index. Hossain et al. (2021) applied various GARCH family models to Bangladesh stock indexes across pre-, during-, and post-GFC periods, concluding that the EGARCH model was the most suitable based on information criteria, while GARCH-M was optimal during and after the crisis based on minimum error. They observed persistent volatility and evidence of the leverage effect on returns. Similarly, Yong et al. (2021) identified the leverage effect in the equity markets of Singapore and Malaysia, though they found no evidence of a risk-return trade-off in either country. Danila et al. (2021) extended the sample to other ASEAN countries using the GJR-GARCH model, identifying volatility clustering and leverage effects in Singapore, Malaysia, and Thailand. In the Indian market, Kaur and Singla (2022) used GARCH, EGARCH, and TGARCH models, determining that the ARIMA-EGARCH model was the best for forecasting volatility. They also confirmed the presence of persistence and leverage effects. Lastly, Arashi and Rounaghi (2022) investigated the market efficiency of the NASDAQ stock exchange using the ARMA-GARCH model, concluding that the NASDAQ is an efficient market, thus supporting the efficient market hypothesis.

DATA AND METHODOLOGY

Data from both the conventional and Islamic equity indexes were collected from Bursa Malaysia to achieve the objectives of this study. Malaysia is chosen due to its commitment to establishing a global Islamic financial system, with the country ranking first in the overall Islamic Finance Development Indicator (IFDI) for ten consecutive years (ICD-Refinitiv, 2022). Additionally, Malaysia has both a conventional and Islamic dual-financial system in place, providing an opportunity for researchers to make comparisons. For this study, the conventional FTSE Bursa Malaysia KLCI Index (KLCI) and the Islamic FTSE Bursa Malaysia Hijrah Shariah Index (HJS) were utilized. The daily data of 4,175 observations, was obtained from Thomson Reuter Data Stream between February 28, 2007, and February 28, 2023. To provide comprehensive analysis, this study employed daily data for analysis instead of monthly or weekly data (Jebran and Iqbal, 2016). For a thorough analysis, this study utilized daily data rather than monthly or weekly data (Jebran and Iqbal, 2016). Additionally, the data was divided into four subperiods to ensure comprehensive results. Initially, the entire sample was analysed to examine integration and volatility spillover across four indexes and to gain insights into market reactions over the full period. Then, the pre-GFC period, from February 28, 2007, to July 31, 2007, was analysed. Next, the during-GFC period, spanning from August 1, 2007, to July 31, 2009, was studied. The post-GFC period, from August 1, 2009, to February 21, 2020, was also examined. Finally, the period during COVID-19, from February 22, 2020, to February 28, 2023, was analysed to capture the impact of pandemic shocks.

Data Analysis

Following the data-cleaning process, the index price is transformed into a daily logarithmic return as follows:

$$r_t = \ln(\frac{P_t}{P_{t-1}}) \tag{1}$$

This study utilized log returns instead of raw prices because log returns tend to be normally distributed, which can enhance the accuracy of variable predictions. Raw prices, on the other hand, cannot fall below zero and do not follow a normal distribution. Furthermore, log returns can be compounded over time, allowing for the calculation of cumulative returns.

Johansen Cointegration Test

The objective of this paper is to examine the long-run relationship between Islamic and conventional indexes of Malaysia in every sub-period. These techniques predict the financial integration, i.e., the co-movements of equity markets that share mutual stochastic trends. The cointegration techniques were first introduced by

Granger (1981) and further complemented by Engle and Granger (1987) and Johansen (1988). In this research, the Johansen cointegration test is applied, due to its ability to test one or more long-run cointegration vectors, thus relationships. Johansen (1988, 1991) also developed the two methods of the Trace test and maximum-eigenvalue test to test the quantity of long-run cointegration vectors. The framework of Johansen cointegration is based on a VAR model:

$$Y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + Bx_t + \varepsilon_t \tag{2}$$

where Y_t is the $n\,x1$ vector of the I (1)-variable, x_t is a d-vector of deterministic trends and ε_t is the residual's white noise vector.

The rewrite of this VAR is as follows:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_t + Bx_t + \varepsilon_t \tag{3}$$

where:

$$= \sum_{i=1}^{p} A_i - I,\ \Gamma_i = -\sum_{j=i+1}^{p} A_j \tag{4}$$

The appropriate lag length prior to the Johansen cointegration test is first determined by using Akaike's information criterion.

Econometric Model

This study investigates the return spillover, risk-return trade-off, and volatility spillover between KLCI conventional and HJS Islamic equity indexes. The authors utilize GARCH-Mean (GARCH-M) and EGARCH models to ensure the accuracy and reliability of their findings. The research methodology involved a two-phases-stepwise method by Jebran and Iqbal (2016) to analyse the return and volatility spillover between the two equity indexes. In the first phase, the authors derive the volatility residuals for every index by employing the GARCH (1,1) model, whereby they are used as a substitute for shock spillover. In the second phase, the derived volatility residuals are introduced to the mean and variance equation of GARCH-M and EGARCH, respectively, as a substitute for shocks originating.

Symmetric GARCH-M Hybrid Model

The study starts with the analysis of the symmetric GARCH-Mean (GARCH-M) hybrid model (Engle et al., 1987):

$$\mu_{kt} = E(Y_t \mid I_{t-1}) = c + Y_{kt-1} + \partial\, \vartheta_t \tag{5}$$

where μ_{kt} denotes the expected return of k market at time t; ∂ denotes the slope parameter of conditional variance at t; ϑ_t denoted the conditional variance at t and Y_{kt-1} is the return of k market at time t-1. The SGARCH-Mean hybrid model incorporates the volatility into the mean, with δ known as a risk-return trade-off or risk premium. When the coefficient ∂ is above 0 and significant, it implies that an increase in risks results in a surge in the mean return. Hence, the two-phases-stepwise method of specification of the GARCH-M model:

$$R_{t(r)} = \aleph_1 + \aleph_2 R_{t-1} + \Psi(resid_{equity\ indexes}) + \varepsilon_t \tag{6}$$

$$\mu_{kt} = E(Y_t \mid I_{t-1}) = c + Y_{kt-1} + \partial\, \vartheta_t + \delta(resid_{equity\ indexes}) \tag{7}$$

Asymmetric-EGARCH Hybrid Model

The EGARCH model, developed by Nelson (1991), overcomes the non-negativity constraints present in the SGARCH model. Following the initial ARIMA fitting, the next step involves applying the Asymmetric EGARCH model as follows:

$$\ln(\vartheta_t) = \omega_0 + \omega_1 \left(\frac{\varepsilon_{t-1}}{\vartheta_{t-1}^{0.5}}\right) + \gamma_1 \left|\frac{\varepsilon_{t-1}}{\vartheta_{t-1}^{0.5}}\right| + \omega_2 \ln(\mu_{t-1}) \quad (8)$$

The EGARCH model uses the natural logarithm to ensure the non-negativity of the variance. In this model, the parameters $\omega_0,\ \omega_1,\ \omega_2\ and\ \gamma_1$ are constants. If the γ parameter is negative and significant, it indicates the presence of the leverage effect, where a negative shock results in higher volatility compared to a positive shock of the same magnitude.

$$R_t = \aleph_1 + \aleph_2 R_{t-1} + \Psi(resid_{equity\ indexes}) + \varepsilon_t \quad (9)$$

$$\ln(\vartheta_t) = \omega_0 + \omega_1 \left(\frac{\varepsilon_{t-1}}{\vartheta_{t-1}^{0.5}}\right) + \gamma_1 \left|\frac{\varepsilon_{t-1}}{\vartheta_{t-1}^{0.5}}\right| + \omega_2 \ln(\mu_{t-1}) + \delta(resid_{equity\ indexes}) \quad (10)$$

Equations (6) and (8) represent conditional mean equations for both GARCH-M and EGARCH models, where R_t represents return; $\aleph_1$ denotes intercept; $\aleph_2$represents the effect of own lagged return; Ψ is the return spillover from other equity indexes to investigated index. Equations (7) and (9) represent conditional equations, where ω_0 is the constant; $\omega_1$represents consistence; ω_2 denotes persistence; $\gamma_1$is he coefficient for asymmetric effect; $\delta(resid_{equity\ indexes})$ is the derived volatility residuals, as a substitute for shocks.

Granger Causality Test

The study used the Granger causality test to identify short-term interdependence between sample stock markets. It specifically applied the test to trace causal linkages between conventional and Islamic index return series. Granger causality is a statistical method for analysing causal relationships between two time series data, where if a time series Y can predict another time series X, then Y is said to Granger cause X.

$$p_t^q = \alpha_q + \sum_{i=1}^{n} \emptyset_i p_{t-i}^q + \sum_{j=1}^{m} \vartheta_j p_{t-j}^q + \mathrm{U}_t^q \quad (11)$$

$$p_t^S = \alpha_S + \sum_{i=1}^{n} \emptyset_i p_{t-i}^S + \sum_{j=1}^{m} \vartheta_j p_{t-j}^S + \mathrm{U}_t^S \quad (12)$$

Variance Decomposition Test

The study utilized the variance decomposition test, a statistical tool in financial econometrics, to measure the contribution of various factors to the variation of a financial time series. The test is based on the estimation of a vector autoregression (VAR) model, which describes the joint dynamics of several related variables, providing a framework for analysing the dynamic relationships between financial variables. The VAR model is estimated using maximum likelihood methods, and the estimated parameters are used to generate forecasts of the variables of interest. The variance decomposition test involves decomposing the forecast error variance of each variable into its component parts and calculating the percentage of the total forecast error variance that can be attributed to each variable. The results provide important insights into the dynamic relationships between financial variables, enabling a better understanding of the factors driving the behaviour of the financial time series and facilitating analysis of spillover effects between different financial markets.

Impulse Response Function

Impulse response function (IRF) is a concept used in signal processing and system analysis to describe the response of a system to an impulse input. In mathematical terms, an impulse is a brief signal of infinite magnitude and infinitesimal duration. When an impulse is applied to a system, the system responds with a characteristic output, which is the impulse response. The impulse response function is the mathematical representation of this output. The impulse response function is used to analyse the behaviour of a system and to determine its characteristics such as stability, linearity, and time-invariance. It is also used in the design of digital filters, equalizers, and other signal-processing systems. The impulse response function is usually represented graphically as a time-domain waveform. It shows the output of the system in response to a single impulse, and it provides information about the system's frequency response, phase response, and time-domain behaviour.

RESULTS AND DISCUSSION

Descriptive Statistics

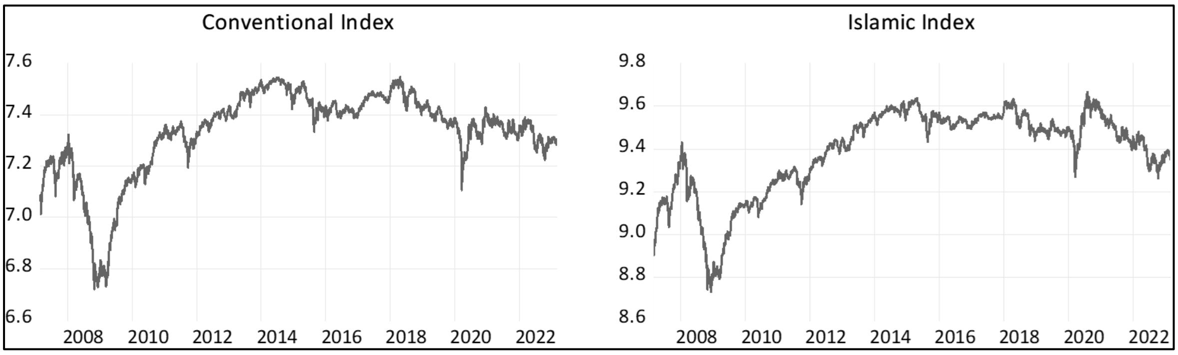
Table 1 provides the descriptive statistics for the Conventional and Islamic Indexes across different periods, including the full period, pre-GFC, during-GFC, post-GFC, and during COVID-19. Between February 28th, 2007, and February 28th, 2023, both the conventional and Islamic indexes were observed daily, resulting in a total of 4,175 observations. During the periods of the GFC and COVID-19, negative mean returns were recorded for both indexes, indicating losses outweighed gains. However, during the post-GFC period, positive mean returns were observed for both indexes. The standard deviation values indicate the daily return fluctuations for both indexes, with the Islamic index consistently exhibiting larger values. Comparing the during-GFC and during-COVID-19 periods to the entire period and the post-GFC period, both indexes experienced negative mean returns with a significant deviation from the mean. This highlights the volatility of equity market returns during these crisis periods.

The kurtosis values for both indexes were exceptionally high, well above the normal value of 3, indicating a leptokurtic (fat-tailed) distribution and a high probability of extreme values. The skewness coefficients for both indexes also deviated from zero, suggesting an asymmetric and potentially nonlinear distribution. Notably, during the COVID-19 period, only the Islamic index displayed a positive skewness value, implying the potential for substantial returns to offset minor losses. The Jarque-Bera statistic was statistically significant for all indexes, confirming that the logarithmic return distributions were not normally distributed. The study observed volatility clustering, where large variations are likely to follow large variations, and small variations follow small variations, due to the correlations in financial data. The ARCH test results indicated temporal dependencies in every scenario, reflecting higher moments of the return distribution.

Table 1 Descriptive Statistics

Period	Mean	Median	SD	Skewness	Kurtosis	CV	Jarque-Bera		ARCH effect	
Conventional Index										
Full Period	0.0047	0.0000	0.7425	-0.7918	16.6008	158.83	32607.76	**	101.29	**
Pre-GFC	0.1267	0.2035	0.9671	-1.2501	8.4529	7.63	163.43	**	10.85	**
During-GFC	-0.0299	0.0000	1.1917	-1.1263	12.7739	-39.87	2192.34	**	6.49	*
Post-GFC	0.0096	0.0000	0.5482	-0.3779	5.9636	57.02	1073.80	**	109.84	**
During-COVID	-0.0066	0.0000	0.8941	-0.0302	10.4975	-136.45	1843.44	**	100.49	**
Islamic Index										
Full Period	0.0093	0.0000	0.8120	-0.7354	15.9762	87.60	29660.52	**	55.39	**
Pre-GFC	0.1841	0.2236	0.9929	-0.6383	5.7460	5.39	41.65	**	32.02	**
During-GFC	-0.0159	0.0000	1.3353	-1.1276	12.7816	-83.76	2195.84	**	8.24	*
Post-GFC	0.0138	0.0000	0.5775	-0.2574	6.4124	41.90	1367.09	**	45.16	**
During-COVID	-0.0140	0.0000	1.0036	0.0225	6.4393	-71.73	387.94	**	27.96	**

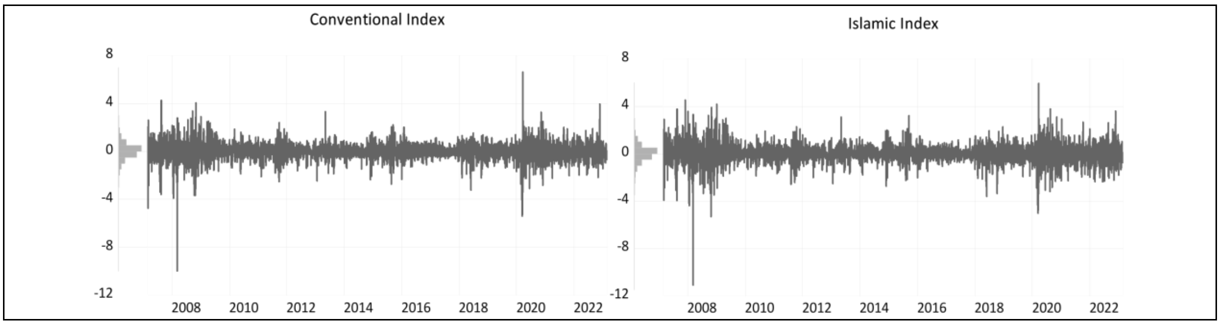
Notes: Author's calculation. **, * indicates significance at 1%, 5% respectively. Mean represents mean returns in %. ADF statistics represent Augmented Dickey and Fuller test for stationarity. PP statistics represent the Phillips and Perron test of stationarity. ARCH effect represents the ARCH test for the presence of heteroskedasticity and autocorrelation in data series. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.



Source: Authors' calculation. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Figure 1 The Market Trend of KLCI and HJS

Figure 1 illustrates the trend of both equity indexes for the entire sample period. The data show that the Islamic equity index behaves quite similarly to its conventional counterpart. Figure 2 shows the daily logarithmic returns appear to be stable around a constant, with positive and negative fluctuations around the mean. However, during the GFC and COVID-19 periods, both Islamic and conventional indexes experienced significant volatility, as shown in the closing logarithmic price progression and daily returns. During the opening two months of COVID-19 and the GFC period, both equity indexes experienced significant drops. However, for the post-GFC period, both equity indexes showed a consistent and mean-reverting variance.



Source: Authors' calculation. Notes: The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Figure 2 Returns: Full period

Correlation Analysis

To examine the relationships between the indexes during different periods, the study conducted correlation tests and presented the results in Table 2. The correlation matrix illustrates how the inter-linkages changed over time. The findings reveal that the correlation coefficient was highest (0.994) in the pre-GFC period and decreased over time, with the lowest coefficient (0.662) recorded during the COVID-19 period between both indexes. This indicates that the COVID-19 crisis is different from the GFC, making it unique from the previous financial crisis. For investors, the varying correlations highlight the importance of understanding the nature of different crises. While Islamic and conventional indices generally move together, certain crises can create unique opportunities for diversification.

Table 2 Correlation Matrix

	Conventional Index
Full period	
Islamic Index	0.9343
Pre-GFC	
Islamic Index	0.9943
During-GFC	
Islamic Index	0.9776
Post-GFC	
Islamic Index	0.9412
During-COVID	
Islamic Index	0.6622

Source: Authors' calculations. Notes: The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 31/7/2009, post-GFC is 1/8/2009 21/2/2020 and during-COVID is 24/2/2020 28/2/2023.

Heteroskedasticity Analysis

The presence of heteroscedasticity in the variance is confirmed using the ARCH-LM test, which further proves the existence of volatility clustering. This allows for the use of models, such as GARCH-Mean and EGARCH, in both symmetrical and asymmetrical applications. The findings have been summarized in Table 1.

Johansen Cointegration Test

Table 3 provides the results of the Johansen cointegration test, which is used to assess the long-term connection between the selected markets. The trace-test and maximum-eigenvalue test are employed to investigate the cointegration between the indexes. The results of these tests indicate that the only significant long-term associations between Malaysia's conventional and Islamic indexes are in the pre-GFC and during the COVID-19 period. However, no conclusive significant long-run relationship is detected in the full, during- and post-GFC periods. These findings suggest that there may be ample diversification opportunities for investors and portfolio managers in Malaysia. Moreover, the results suggest that the behaviour of both indexes differs in the COVID-19 crisis compared to the GFC. The dissimilar characteristics of the COVID-19 period from the GFC make the former a unique crisis.

Table 3 Johansen Cointegration Test

	Full Period			**Pre-GFC**				**During-GFC**		
Hypothesized No. of CE(s)	Lag	Trace Statistic	Max-Eigen Statistic	Lag	Trace Statistic		Max-Eigen Statistic	Lag	Trace Statistic	Max-Eigen Statistic
r ≤ 0	2	11.6571	8.0813	1	15.8399	*	12.5838	1	11.2480	9.3838
r ≤ 1		3.5758	3.5758		3.2561		3.2561		1.8642	1.8642

	Post-GFC			**During-COVID-19**				
Hypothesized No. of CE(s)	Lag	Trace Statistic	Max-Eigen Statistic	Lag	Trace Statistic		Max-Eigen Statistic	
r ≤ 0	1	13.3782	11.2912	2	16.6783	*	15.2820	*
r ≤ 1		2.0870	2.0870		1.3963		1.3963	

Source: Authors' calculation. Notes: ** and * denotes significant at 1% and 5% respectively. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Table 4 Results of Granger Causality Test

Null Hypothesis			**Full Period**	**Pre-GFC**		**During-GFC**	**Post-GFC**	**During-COVID**	
MY_CI	≠→	MY_II	1.859675	4.7332	*	1.310117	2.33552	6.44228	*
MY_II	≠→	MY_CI	0.050105	0.0918		0.54701	1.46845	4.17764	

Note: * Chi-sq

Source: Authors' calculation. Notes: ** and * denotes significant at 1% and 5% respectively. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Causal Relationship – Granger Causality Test

The results of the Granger Causality test to identify the short-run relationship between Malaysia's Islamic and conventional indexes. Once the appropriate lag length is determined, a bivariate VAR model is used to apply the test. The F-statistics results are presented in Table 4. The absence of Granger causality links between the indexes is observed during the full, during- and post-GFC periods. Nevertheless, in the pre-GFC and during-COVID-19 periods, a unidirectional short-run causal relationship is found from the conventional index to the Islamic index. These results are consistent with the Johansen integration test mentioned earlier. Additionally, the magnitude of the causal relationship between the two indexes increases during the COVID-19 period compared to the pre-, during-, and post-GFC periods. Hence, there is no short-run relationship is observed between the Islamic index and the conventional index during the full, during- and post-GFC periods. This situation suggests that in the short run, the Islamic index provides an attractive diversification opportunity for Malaysian investors and portfolio managers. These findings indicate that conventional investors may potentially enjoy diversification benefits by combining both indexes in their portfolios. However, the unidirectional causality from the conventional index to the Islamic index during the pre-GFC and COVID-19 periods indicates a short-run relationship between the two indexes. Therefore, any changes in both indexes should be considered for policy-making regarding the Malaysian stock market.

Return and Volatility Spillovers

The GARCH-M and EGARCH models are utilized in the study to estimate the transmission of returns and volatility between the two indexes. Both model's findings are presented in Tables 5, 6, 7, 8, and 9 for the full, pre-, during-, and post-GFC, and the COVID-19 period, respectively. The results indicate several interesting and significant aspects of return and volatility spillovers.

Table 5 GARCH-M and EGARCH Results – Full Period

	GARCH-M (1,1) model						EGARCH (1,1) model					
Coefficients	Conventional Index			Islamic Index			Conventional Index			Islamic Index		
Mean Equation												
Risk Premium	0.1051	*	(0.0475)	-0.0655		(0.0457)						
Constant	0.0863	**	(0.0267)	0.0681	*	(0.0273)	0.0042		(0.0084)	0.0114		(0.0092)
Lagged index return	0.0427		(0.0323)	0.0185		(0.0327)	0.0747	*	(0.0310)	0.0130		(0.0313)
Ψ_Conventional Index				0.0612		(0.0333)				0.0712	*	(0.0328)
Ψ_Islamic Index	0.0301		(0.0282)				0.0106		(0.0267)			
Variance Equation												
Constant	0.0064	**	(0.0007)	0.0056	**	(0.0007)	-0.1158	**	(0.0073)	-0.1077	**	(0.0067)
ARCH effects	0.0848	**	(0.0046)	0.0700	**	(0.0047)	0.1474	**	(0.0083)	0.1487	**	(0.0082)
Leverage effect							-0.0662	**	(0.0049)	-0.0555	**	(0.0046)
GARCH effect	0.9039	**	(0.0042)	0.9215	**	(0.0047)	0.9887	**	(0.0029)	0.9943	**	(0.0020)
δ_Conventional Index				-0.0274	**	(0.0020)				-0.0094	**	(0.0031)
δ_Islamic Index	-0.0305	**	(0.0018)				-0.0053		(0.0032)			
Persistent effect	0.9886			0.9915								
Half-Life	61			81								
Observations	4173			4173			4173			4173		
Q(24)	27.8710		{0.2650}	27.2500		{0.2930}	26.3280		{0.3370}	25.3050		{0.3890}
ARCH-LM	1.5740		{0.2096}	0.0493		{0.8243}	9.0822		{0.1690}	3.5739		{0.0587}
Log likelihood	-466.76			-773.39			-465.73			-784.64		
Iterations	40			42			40			45		
Akaike info criterion	0.2278			0.3749			0.2278			0.3808		
Schwarz criterion	0.2400			0.3871			0.2415			0.3945		
Hannan-Quinn criter.	0.2321			0.3792			0.2326			0.3857		

Source: Authors' calculation. Notes: ** and * denotes significant at 1% and 5% respectively. Standard errors are in parentheses. P-values are in curly brackets. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Dynamics of Return and Volatility Spillovers for the Full Sample

The study finds that only the conventional index in Malaysia is influenced by its own past returns, as indicated by the significant own lagged return spillover. Additionally, the conventional index shows evidence of positive return volatility spillover to the Islamic index in the full sample period. However, there is no conclusive evidence of volatility spillover between the stock markets, which could play an important role in portfolio diversification. Furthermore, the conventional index is the only one to exhibit a risk premium in the full sample period. Based on the findings of the EGARCH model, it is determined that leverage effects are present in all indexes for the entire sample period. A conclusive unidirectional asymmetric volatility spillover from the conventional index to the Islamic index is also detected by the study, which suggests that an asymmetric volatility spillover occurs from the conventional index to the Islamic index during the entire period. Furthermore, the negative volatility spillover coefficient suggests that the conventional index's volatility is decreasing the Islamic index's volatility, which may offer diversification opportunities between both indexes.

Dynamics of Return and Volatility Spillovers for the Pre-GFC Period

The results reveal that there are significant own lagged return spillovers in the conventional index. Additionally, the study highlights a significant unidirectional return spillover from the Islamic index to the conventional index in the pre-GFC period. Furthermore, the research shows evidence of a risk-return trade-off in both the conventional and Islamic indexes during the pre-GFC period. The EGARCH model suggests that leverage effects are present in the conventional index only during the pre-GFC period. Furthermore, the study identifies asymmetric volatility spillovers from the Islamic index to the conventional index. Finally, the positive volatility spillover coefficient suggests that the Islamic index's volatility is increasing the conventional index's volatility.

Dynamics of Return Spillovers for During-GFC

The results reveal that the conventional index experiences significant own lagged return spillovers. Additionally, the conventional index shows evidence of return volatility spillover to the Islamic index. Interestingly, during the GFC period, there is no evidence of a risk premium in either the Islamic or conventional indexes. The EGARCH model results suggest that all indexes exhibit leverage effects during the GFC period. Bidirectional asymmetric volatility spillovers are observed between the Islamic and conventional indexes, with all coefficients being negative and statistically significant, indicating the Islamic index's volatility is decreasing the conventional index's volatility, and vice versa. Overall, the results suggest a significant interdependence between the two indexes during the during-GFC period, with volatility spillovers in both directions.

Table 6 GARCH-M and EGARCH Results – Pre-GFC Period

	GARCH-M (1,1) model						EGARCH (1,1) model					
Coefficients	Conventional Index			Islamic Index			Conventional Index			Islamic Index		
Mean Equation												
Risk Premium	4.7301	**	(0.8305)	0.7801	*	(0.3205)						
Constant	-4.2987	**	(0.7564)	-0.4662		(0.2519)	0.0797	**	(0.0202)	0.1160	*	(0.0582)
Lagged index return	-0.0957		(0.3717)	-0.0460		(0.2067)	-0.2727	**	(0.0746)	-0.0135		(0.1741)
Ψ_Conventional Index				0.2334		(0.2370)				0.3116		(0.1936)
Ψ_Islamic Index	0.3871		(0.3317)				0.2623	**	(0.0851)			
Variance Equation												
Constant	0.9477	**	(0.2094)	0.0283	**	(0.0087)	0.3107	**	(0.0000)	0.2649	**	(0.0022)
ARCH effects	-0.1793	**	(0.0430)	-0.0997	**	(0.0079)	-0.7893	**	(0.0000)	-0.3808	**	(0.0000)
Leverage effect							-0.2963	**	(0.0857)	0.1499		(0.1360)
GARCH effect	1.0845	**	(0.0667)	1.0464	**	(0.0005)	0.7481	**	(0.0000)	0.9240	**	(0.0305)
δ_Conventional Index				-0.0049		(0.0100)				-0.1473		(0.1699)
δ_Islamic Index	0.2638	**	(0.0495)				0.1168	**	(0.0000)			
Persistent effect	0.9051			0.9467								
Half-Life	7			13								
Observations	108			108			108			108		
Q(24)	18.82		{0.7610}	30.00		{0.1850}	20.39		{0.6740}	20.77		{0.6520}
ARCH-LM	0.1295		{0.7189}	0.8212		{0.3648}	0.1024		{0.7490}	0.1742		{0.6764}
Log likelihood	-35.703			-48.095			-38.542			-45.298		
Iterations	79			35			44			28		
Akaike info criterion	0.8093			0.0336			0.8804			1.0055		
Schwarz criterion	1.0080			0.0367			1.1039			1.2290		
Hannan-Quinn criter.	0.8899			0.3121			0.9710			1.0961		

Source: Authors' calculation. Notes: ** and * denotes significant at 1% and 5% respectively. Standard errors are in parentheses. P-values are in curly brackets. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Table 7 GARCH-M and EGARCH Results – During GFC Period

	GARCH-M (1,1) model						EGARCH (1,1) model					
Coefficients	Conventional Index			Islamic Index			Conventional Index			Islamic Index		
Mean Equation												
Risk Premium	-0.1918		(0.2069)	-0.3309		(0.2475)						
Constant	0.2041		(0.2126)	0.4164		(0.2920)	0.0238		(0.0493)	0.0562		(0.0575)
Lagged index return	0.1419		(0.0911)	-0.0611		(0.1030)	0.2464	**	(0.0905)	-0.0631		(0.0950)
Ψ_Conventional Index				0.2432	*	(0.1204)				0.2468	*	(0.1038)
Ψ_Islamic Index	0.0163		(0.0739)				-0.1038		(0.0730)			
Variance Equation												
Constant	0.1570	**	(0.0474)	0.2045	**	(0.0745)	-0.0799	*	(0.0352)	-0.0917	**	(0.0289)
ARCH effects	0.1265	**	(0.0334)	0.0719	**	(0.0214)	0.1567	**	(0.0447)	0.1915	**	(0.0394)
Leverage effect						(0.0573)	-0.1382	**	(0.0324)	-0.1157	**	(0.0305)
GARCH effect	0.7568	**	(0.0570)	0.8003	**	(0.0519)	0.9459	**	(0.0246)	0.9638	**	(0.0260)
δ_Conventional Index				-0.1982	**					-0.0307	**	(0.0079)
δ_Islamic Index	-0.1498	**	(0.0346)				-0.0199	**	(0.0068)			
Persistent effect	0.8833			0.8722								
Half-Life	6			5								
Observations	523			523			523			523		
Q(24)	12.21		{0.9770}	20.13		{0.6890}	12.67		{0.9710}	12.86		{0.9680}
ARCH-LM	1.0311		{0.3099}	10.0389		{0.1230}	0.7702		{0.3801}	0.2004		{0.6544}
Log likelihood	-277.81			-337.72			-280.42			-342.59		
Iterations	133			70			30			45		
Akaike info criterion	1.1917			1.3221			1.1068			1.3445		
Schwarz criterion	1.0930			1.3872			1.1801			1.4178		
Hannan-Quinn criter.	1.1581			1.3476			1.1355			1.3732		

Source: Authors' calculation. Notes: ** and * denotes significant at 1% and 5% respectively. Standard errors are in parentheses. P-values are in curly brackets. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Table 8 GARCH-M and EGARCH Results – Post-GFC Period

	GARCH-M (1,1) model						EGARCH (1,1) model					
Coefficients	Conventional Index			Islamic Index			Conventional Index			Islamic Index		
Mean Equation												
Risk Premium	0.2123	*	(0.0876)	0.1463		(0.0844)						
Constant	-0.0989	*	(0.0423)	-0.0608		(0.0431)	0.0082		(0.0097)	0.0104		(0.0098)
Lagged index return	0.0712		(0.0391)	0.0045		(0.0396)	0.0948	*	(0.0398)	0.0061		(0.0386)
Ψ_Conventional Index				0.0878	*	(0.0401)				0.0931	*	(0.0412)
Ψ_Islamic Index	0.0305		(0.0366)				0.0067		(0.0365)			
Variance Equation												
Constant	0.0099	**	(0.0013)	0.0120	**	(0.0015)	-0.7396	**	(0.1191)	-0.1649	**	(0.0203)
ARCH effects	0.0646	**	(0.0065)	0.0731	**	(0.0073)	0.1409	**	(0.0211)	0.1409	**	(0.0128)
Leverage effect							-0.1456	**	(0.0152)	-0.0804	**	(0.0086)
GARCH effect	0.9038	**	(0.0083)	0.8926	**	(0.0091)	0.6676	**	(0.0586)	0.9580	**	(0.0090)
δ_Conventional Index				-0.0322	**	(0.0043)				0.0303		(0.0174)
δ_Islamic Index	-0.0372	**	(0.0037)				0.5036	**	(0.1120)			
Persistent effect	0.9683			0.9657								
Half-Life	22			20								
Observations	2755			2755			2755			2755		
Q(24)	8.48		{0.9990}	11.35		{0.9860}	21.35		{0.6180}	21.94		{0.5830}
ARCH-LM	0.3442		{0.5574}	0.6002		{0.4385}	15.0966		{0.0883}	5.3668		{0.1468}
Log likelihood	259.983			117.316			261.260			113.106		
Iterations	52			47			51			55		
Akaike info criterion	-0.1829			-0.0794			-0.1831			-0.0756		
Schwarz criterion	-0.1657			-0.0622			-0.1638			-0.0562		
Hannan-Quinn criter.	-0.1767			-0.0731			-0.1761			-0.0686		

Source: Authors' calculation. Notes: ** and * denotes significant at 1% and 5% respectively. Standard errors are in parentheses. P-values are in curly brackets. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Table 9 GARCH-M and EGARCH Results – During Covid-19 Period

	GARCH-M (1,1) model						EGARCH (1,1) model					
Coefficients	Conventional Index			Islamic Index			Conventional Index			Islamic Index		
Mean Equation												
Risk Premium	0.2419		(0.1702)	0.1263		(0.1858)						
Constant	-0.1915		(0.1297)	-0.1291		(0.1661)	-0.0136		(0.0278)	-0.0267		(0.0327)
Lagged index return	-0.0513		(0.0681)	0.0513		(0.0754)	-0.0551		(0.0644)	0.0531		(0.0761)
Ψ_Conventional Index				-0.1116		(0.0807)				-0.1167		(0.0806)
Ψ_Islamic Index	0.0074		(0.0594)				0.0173		(0.0590)			
Variance Equation												
Constant	0.0157	**	(0.0055)	0.0067	**	(0.0018)	-0.0470	**	(0.0130)	-0.0291	*	(0.0118)
ARCH effects	0.0441	**	(0.0109)	0.0081		(0.0051)	0.0715	**	(0.0163)	0.0394	**	(0.0145)
Leverage effect							-0.0224	*	(0.0111)	-0.0126		(0.0094)
GARCH effect	0.9283	**	(0.0157)	0.9809	**	(0.0059)	0.9999	**	(0.0072)	0.9958	**	(0.0052)
δ_Conventional Index				-0.0118		(0.0115)				-0.0040		(0.0041)
δ_Islamic Index	0.0007		(0.0115)				-0.0088		(0.0054)			
Persistent effect	0.9724			0.9890								
Half-Life	25			63								
Observations	787			787			787			787		
Q(24)	35.30		{0.0640}	23.24		{0.5060}	34.15		{0.0820}	22.58		{0.5450}
ARCH-LM	0.5147		{0.4731}	0.3521		{0.5529}	0.6610		{0.4162}	0.0292		{0.8644}
Log likelihood	-335.96			-437.08			-324.76			-425.67		
Iterations	46			42			53			52		
Akaike info criterion	0.8797			1.1383			0.8536			1.1117		
Schwarz criterion	0.9274			1.1860			0.9073			1.1653		
Hannan-Quinn criter.	0.8980			1.1566			0.8742			1.1323		

Source: Authors' calculation. Notes: ** and * denotes significant at 1% and 5% respectively. Standard errors are in parentheses. P-values are in curly brackets. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Dynamics of Return and Volatility Spillovers for Post-GFC

Comparable to the period during GFC, the own lagged return spillover of the conventional index is significant, suggesting that only the past returns of the conventional index in Malaysia have an impact on its current returns. The study also found evidence of return volatility spillover from the conventional index to the Islamic index in the post-GFC period. Furthermore, the results indicate that the risk premium only exists in the conventional index in the post-GFC period. In terms of the dynamics of volatility spillovers for the post-GFC period, the EGARCH model findings suggest that leverage effects exist in both the Islamic and conventional indexes. Additionally, unidirectional asymmetric volatility spillover from the Islamic index to the conventional index is observed, with all coefficients being positive and significant, implying that shocks in the Islamic index increase the volatility of the conventional index.

Dynamics of Return and Volatility Spillovers for During-Covid-19

During the COVID-19 period, there is no significant coefficient observed in either index with regards to their own lagged returns, and no evidence of return volatility spillover is found between the Islamic index and the conventional index. Additionally, no risk-return trade-off was observed during this period. The results of the EGARCH model indicate that there are leverage effects in the conventional index during the COVID-19 period, but no asymmetric volatility spillovers are observed in either index. Finally, the reliability and robustness of the GARCH-M and EGARCH models are confirmed by conducting the ARCH-LM test and the Ljung-Box (LB) statistics for twenty-four lags (Q24). Both tests indicate the absence of serial correlation and the ARCH effect, suggesting that the results of this study are reliable and robust.

Variance Decomposition Tests

Table 10 reports the results of the variance decomposition test used in this study to examine the contribution of variance to the variances of the other variables. Specifically, the analysis was conducted by estimating a VAR model and decomposing the variance of each index into its own shocks and the shocks from the other index. The findings show that the Islamic index contributes barely to the variation of the conventional index for each sample period. Contrarily, the conventional index accounts for 82 to 90% of the changes in the Islamic index in the full, pre, during- and post-GFC periods. However, during the COVID-19 period, the conventional index only explains approximately 75% of the variations in the Islamic index, indicating a decrease in the contribution of the variation, indicating a potential change in the relationship between the two indexes during periods of economic turmoil. Overall, the findings suggest that fluctuations in the conventional index have a greater effect on the Islamic index compared to the reverse scenario.

Table 10 Variance Decomposition Tests Results

Full Period

Conventional Index				Islamic Index			
Period	S.E.	LNCI	LNII	Period	S.E.	LNCI	LNII
1	0.007406	100.0000	0.000000	1	0.008099	82.33205	17.66795
2	0.010775	99.99974	0.000260	2	0.011806	83.12882	16.87118
3	0.013451	99.99983	0.000167	3	0.014658	83.50325	16.49675
4	0.015684	99.99987	0.000131	4	0.017043	83.71446	16.28554
5	0.017636	99.99987	0.000130	5	0.019129	83.85409	16.14591
6	0.019388	99.99984	0.000162	6	0.021004	83.95738	16.04262
7	0.020990	99.99977	0.000225	7	0.022721	84.04001	15.95999
8	0.022475	99.99968	0.000319	8	0.024312	84.10985	15.89015
9	0.023864	99.99956	0.000442	9	0.025801	84.17120	15.82880
10	0.025173	99.99941	0.000594	10	0.027204	84.22664	15.77336

Pre-GFC

Conventional Index				Islamic Index			
Period	S.E.	LNCI	LNII	Period	S.E.	LNCI	LNII
1	0.009599	100.0000	0.000000	1	0.009879	85.52125	14.47875
2	0.013074	99.86722	0.132780	2	0.013942	86.75276	13.24724
3	0.015499	99.62941	0.370586	3	0.017018	87.70875	12.29125
4	0.017393	99.34026	0.659745	4	0.019562	88.46201	11.53799
5	0.018959	99.03407	0.965934	5	0.021753	89.06372	10.93628
6	0.020299	98.73155	1.268452	6	0.023682	89.55044	10.44956
7	0.021473	98.44430	1.555703	7	0.025407	89.94869	10.05131
8	0.022520	98.17806	1.821937	8	0.026964	90.27800	9.722001
9	0.023465	97.93500	2.064997	9	0.028381	90.55294	9.447055
10	0.024326	97.71515	2.284848	10	0.029677	90.78457	9.215433

During GFC

Conventional Index				Islamic Index			
Period	S.E.	LNCI	LNII	Period	S.E.	LNCI	LNII
1	0.009599	100.0000	0.000000	1	0.009879	85.52125	14.47875
2	0.013074	99.86722	0.132780	2	0.013942	86.75276	13.24724
3	0.015499	99.62941	0.370586	3	0.017018	87.70875	12.29125
4	0.017393	99.34026	0.659745	4	0.019562	88.46201	11.53799
5	0.018959	99.03407	0.965934	5	0.021753	89.06372	10.93628
6	0.020299	98.73155	1.268452	6	0.023682	89.55044	10.44956
7	0.021473	98.44430	1.555703	7	0.025407	89.94869	10.05131
8	0.022520	98.17806	1.821937	8	0.026964	90.27800	9.722001
9	0.023465	97.93500	2.064997	9	0.028381	90.55294	9.447055
10	0.024326	97.71515	2.284848	10	0.029677	90.78457	9.215433

Post-GFC

Conventional Index				Islamic Index			
Period	S.E.	LNCI	LNII	Period	S.E.	LNCI	LNII
1	0.005455	100.0000	0.000000	1	0.005752	82.65887	17.34113
2	0.008036	99.97262	0.027378	2	0.008455	83.67237	16.32763
3	0.009983	99.96267	0.037327	3	0.010500	83.99792	16.00208
4	0.011600	99.95766	0.042335	4	0.012201	84.14898	15.85102
5	0.013008	99.95463	0.045367	5	0.013687	84.23188	15.76812
6	0.014271	99.95257	0.047434	6	0.015021	84.28157	15.71843
7	0.015422	99.95104	0.048960	7	0.016241	84.31263	15.68737
8	0.016487	99.94985	0.050153	8	0.017371	84.33222	15.66778
9	0.017480	99.94887	0.051126	9	0.018427	84.34424	15.65576
10	0.018414	99.94805	0.051947	10	0.019421	84.35099	15.64901

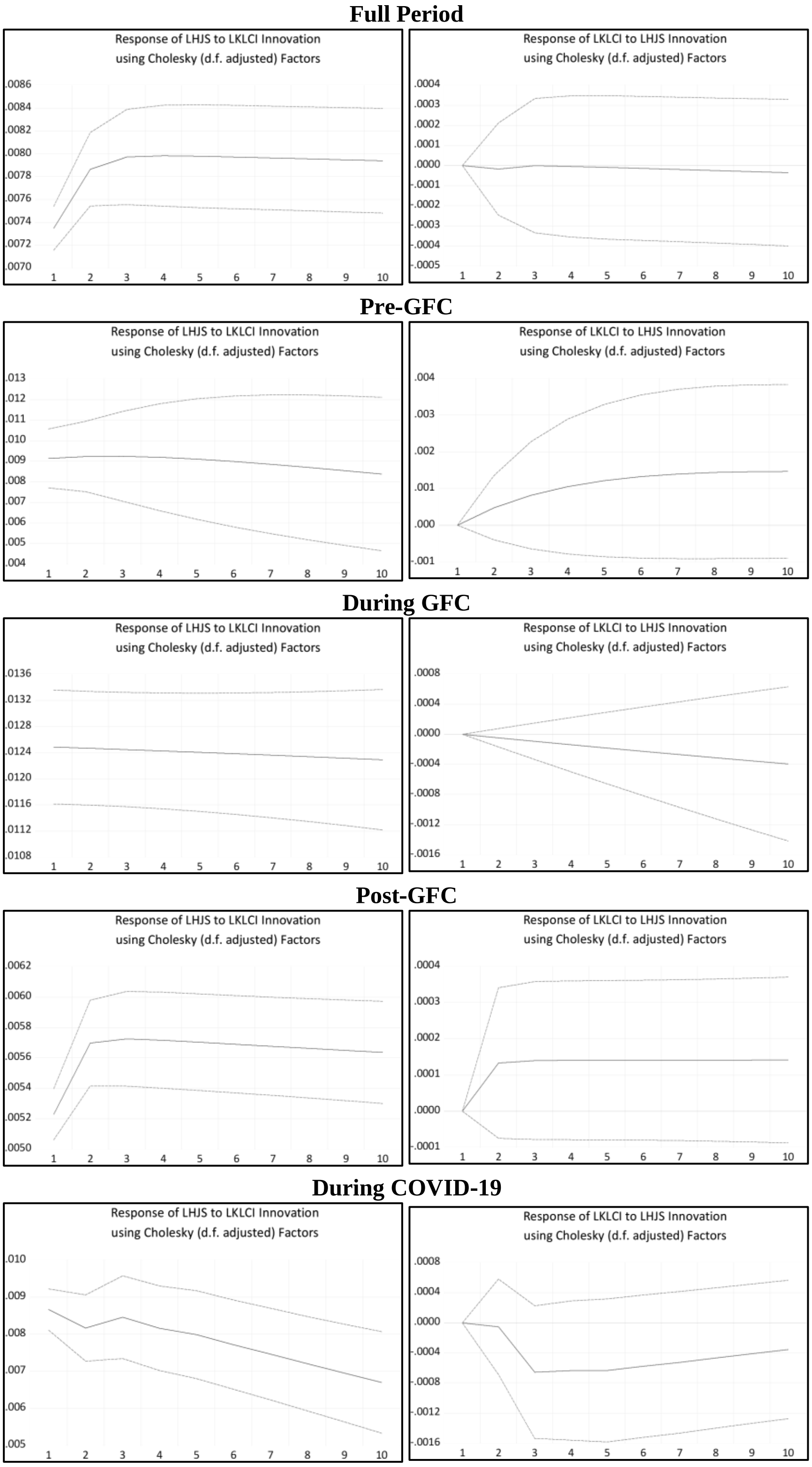
During COVID-19

Conventional Index				Islamic Index			
Period	S.E.	LNCI	LNII	Period	S.E.	LNCI	LNII
1	0.008855	100.0000	0.000000	1	0.009942	75.99821	24.00179
2	0.012318	99.99822	0.001785	2	0.013842	74.01921	25.98079
3	0.015422	99.81873	0.181266	3	0.016827	75.37111	24.62889
4	0.017891	99.73988	0.260119	4	0.019234	75.68816	24.31184
5	0.020021	99.69272	0.307283	5	0.021312	75.69745	24.30255
6	0.021859	99.67293	0.327071	6	0.023124	75.43502	24.56498
7	0.023481	99.66668	0.333318	7	0.024735	75.02813	24.97187
8	0.024928	99.66925	0.330751	8	0.026185	74.51492	25.48508
9	0.026231	99.67689	0.323109	9	0.027503	73.92922	26.07078
10	0.027414	99.68754	0.312465	10	0.028710	73.28920	26.71080

Source: Authors' calculation. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Impulse Response Function

The impulse response function is created by calculating the VAR model in this study to compare how the conventional and Islamic indexes respond to quick, abrupt shocks. Both indexes' impulse response functions are shown in Figure 3 for comparison.



Source: Authors' calculation. The sample period is from 28/2/2007 to 28/2/2023. Pre-GFC is from 28/2/2007 to 31/7/2007, during-GFC is 1/8/2007 to 31/7/2009, post-GFC is 1/8/2009 to 21/2/2020 and during-COVID is 24/2/2020 to 28/2/2023.

Figure 3 Impulse response Function Results

Based on the analysis of Figure 3, it can be observed that the conventional index does not demonstrate a significant response to the Islamic index in various sample periods, while the Islamic index exhibits a positive response to the shocks originating from the conventional index. It suggests that there may be a unidirectional relationship between the two indexes, with the Islamic index not affecting the conventional index significantly, while the Islamic index appears to be impacted by the conventional index. During the COVID-19 periods, both conventional and Islamic equity indexes exhibited higher volatility and a shorter-lived structure. This suggests that investors transferred risk perceptions more rapidly among the equity markets during times of crisis. As a result, it can be inferred that the dynamics of volatility spillover between both underwent significant changes during the COVID-19 period.

Discussion of Results

The results highlight that the ARCH effect, which measures how surprises affect volatility, is higher for the conventional index than the Islamic index during the GFC and COVID-19 periods. The study found that the ARCH effect decreased significantly over time for both indexes, suggesting that both indexes are becoming less responsive to new shocks over time. Notably, the ARCH effect in the Islamic index is statistically insignificant following the COVID-19 period. Overall, these findings suggest that shocks have a slightly greater impact on the conventional index than the Islamic index, and both markets are becoming less responsive to fresh surprises over time.

Volatility clustering, as captured by the GARCH effect, shows substantial persistence in both Islamic and conventional equity indexes across four different sample periods, with the Islamic index exhibiting slightly greater persistence. The GARCH coefficient has risen markedly from the pre-GFC period through to the COVID-19 period, signalling increased volatility and a growing dependence on past volatility. The COVID-19 period has pushed the GARCH effect closer to unity. This study indicates that both indexes display a memory extending beyond a single period, with their volatility being more influenced by past values than by new market shocks (Hossain et al., 2021). The study found that both indexes in Malaysia have a high level of volatility clustering and volatility persistency, with the Islamic index exhibiting slightly higher persistence than its conventional counterpart in the full, pre-GFC, and COVID-19 periods. This persistence has increased from the pre-GFC to the COVID-19 period, leading to a potential price mismatch between the two markets and an arbitrage opportunity. However, the Islamic index has been less persistent than the conventional index the during GFC period, possibly due to the defensiveness of Shariah screening and the exclusion of non-Shariah compliant financial institutions. These results are consistent with previous studies (Abduh, 2020; Hassan et al., 2022).

The study examines the Half-Life measure of volatility (Bhar and Nikolova, 2009) for both indexes in Malaysia. The results reveal that the Half-Life for the conventional index increased from 7 days in the pre-GFC period to 25 days during the COVID-19 period. In contrast, the Islamic index saw a more substantial rise, from 13 days to 68 days during the same period. These findings indicate that the Islamic index exhibits greater volatility persistence, with volatility taking nearly twice as long to revert to its unconditional mean compared to the conventional index. During the GFC period, the Half-Life for both indexes was approximately 6 days. The study's findings align with Bahloul and Khemakhem (2021), which noted that volatility shocks persisted longer in Islamic equity indexes during the COVID-19 period, rendering them riskier than conventional indexes. This increased risk in Islamic indexes can be attributed to factors such as Shariah compliance filtering criteria, limited diversification, smaller firm sizes, and sector concentration. For instance, the HJS Islamic index invests in smaller firms, with an average market capitalization of MYR8,506 million, focusing on sectors like Telecommunications, Food and Beverage and Utilities (FTSE Russell, 2022a). In contrast, the KLCI conventional index is concentrated in larger firms with an average market capitalization of MYR15,823 million, predominantly in the Financial and Consumer sectors (FTSE Russell, 2022b). This disparity in firm size, leverage, and diversification highlights the key differences between Islamic and conventional indexes.

Before the COVID-19 pandemic, the Islamic index exhibited a lower risk relative to its mean return compared to the conventional index. However, during the pandemic, the Islamic index underperformed in terms of mean returns and showed higher risk per unit of mean return compared to its conventional counterpart. This indicates that the Islamic index's safe-haven characteristics were diminished during the COVID-19 period. The study concludes that the COVID-19 pandemic significantly increased volatility in both

Malaysian Islamic and conventional equity markets, aligning with previous research findings(Bahloul and Khemakhem, 2021; Bui et al., 2022; Contessi and De Pace, 2021; Goodell, 2020; Kang et al., 2023). The GARCH-Mean model shows that there is a risk-return trade-off in the conventional equity index in the full sample, pre- and post-GFC periods, implying increased market risk leading to better returns due to speculation for short-term profit opportunities. Therefore, the findings of this study contradict the results of Yong et al. (2021) and Akinlaso et al. (2021) and, who discovered minimal probability for abnormal returns in equity markets. The coefficient of the risk premium for the Islamic index is insignificant for all sub-periods, except for the pre-GFC period. The result indicates an absence of risk-return trade-off with no link between volatility and risk premium in the Islamic index, and risk-averse investors tend to be more interested in exploiting investment opportunities (Yong et al., 2021). The sum of ARCH Term and GARCH term of Islamic and conventional indexes are between 0.872 and 0.989, revealing that both markets are weak-form inefficient.

The study discovers evidence of both a leverage effect and an asymmetric effect, indicating that negative shocks has a stronger impact on the conditional variance than positive shocks (Akinlaso et al., 2021; Danila et al., 2021; Hossain et al., 2021; Kaur and Singla, 2021; Yong et al., 2021). However, the Islamic index in the pre-GFC and during COVID-19 periods, show no leverage effect. Overall, the study concludes that the COVID-19 financial crisis is unique based on its findings. For the volatility spillover, the study finds that financial integration increases during the GFC, leading to bidirectional spillovers of volatility between equity markets. However, there are lower correlations and no financial integration the during COVID-19 period. Whereas, there are unidirectional shock spillovers in all periods. The results indicate that the relationship between the two indexes is asymmetrical, with the conventional index having a greater impact on the Islamic index. The absence of significant long-term relationships between the indexes suggests that there may be ample diversification opportunities for investors and portfolio managers in Malaysia. Moreover, the study finds that the behaviour of both indexes differs in the COVID-19 crisis compared to the GFC, making the former a unique crisis. The possible explanation is the nature of the GFC and COVID-19 crises differed, with the former being a financial crisis and the latter being a health crisis brought about by the novel coronavirus. The government response also differed, with the COVID-19 crisis requiring an unprecedented global response including lockdowns, financial support, and vaccine development, while the GFC saw governments implement policies such as bailouts and fiscal stimulus. Additionally, the response to the COVID-19 crisis was more rapid and coordinated, and the long-term impacts may differ as well. Overall, the findings suggest that conventional investors may combine both Islamic and conventional indexes of Malaysia in their portfolio to enjoy diversification benefits.

Summaries of Findings

- The results indicate that the volatility spillovers and impact of the conventional index on the Islamic index are greater and the relationship between the two indexes is asymmetrical.
- The Johansen cointegration and Granger causality tests show the lack of significant short-run and long-run relationships between the Islamic and conventional indexes in the full, during- and pre-GFC periods. This indicates that conventional investors could potentially benefit from diversifying their portfolios by investing in both conventional and Islamic indexes in Malaysia.
- The Malaysian equity indexes show long-term dependence and negative leverage effects with an increase in volatility and dependency on lagged volatility. Additionally, the Islamic index demonstrated safe-haven properties during the GFC.
- Positive risk-return associations are observed in the conventional index across the full sample, as well as the pre- and post-GFC periods, and in the Islamic equity index during the pre-GFC period. Overall, this suggests that investors in Malaysia's conventional indexes are typically rewarded for assuming additional risks. Notably, risk premiums are found to be insignificant during both the GFC and the COVID-19 periods.
- During the COVID-19 period, the Islamic index displayed greater volatility persistency and took longer to revert to its unconditional mean compared to the conventional index, suggesting that it is riskier. This implies that the HJS Islamic index is more volatile than the KLCI conventional index.
- This study consistently shows that both conventional and Islamic indexes in Malaysia exhibit weak-form inefficient market behavior.
-

- Evidence of the leverage effect indicates that negative news leads to a more pronounced increase in return volatility for both indexes.
- There are no significant return and volatility spillovers detected during the COVID-19 period.
- The study discovers that the behavior of conventional and Islamic indexes during the COVID-19 crisis differs from that observed during the GFC, highlighting the unique nature of the former crisis.

CONCLUSION

This study explores the short- and long-term integration, volatility spillover, and volatility characteristics of conventional and Islamic indexes in Malaysia during different periods, including pre-, during-, and post-GFC, as well as the COVID-19 period. Symmetrical GARCH-M and asymmetrical EGARCH models are employed over five sample periods. Additionally, the study examines the risk-return trade-off and market efficiency of both indexes. The study concludes that the short- and long-term relationships are absent between the Islamic and conventional indexes in the full, during- and pre-GFC periods. This indicates that conventional investors could potentially benefit from diversifying their portfolios by investing in both Islamic and conventional indexes in Malaysia. The study also finds that the COVID-19 crisis is distinct from the GFC, and the conventional index has a greater impact on the Islamic index, with an asymmetrical relationship between the two. Risk-averse Islamic portfolio managers and investors should consider incorporating other shariah-compliance asset classes to minimize systematic risks in their portfolios, while conventional investors should consider incorporating the Islamic index with their existing conventional index to enjoy diversification benefits. The study's findings have significant implications for economic policymakers and investors as the integration of financial markets suggests potential diversification opportunities for investors and financial sector integration. Policymakers can leverage these insights to develop strategies to address health and economic crises, enhance global financial stability, and improve market efficiency. Further research is recommended to explore different frameworks, such as various multivariate GARCH models and wavelet-based approaches, to further understand the interactions between conventional and Islamic equity markets in different regions and countries. This would provide a more nuanced view of financial market dynamics and assist policymakers and investors in making better-informed decisions.

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