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Co-movement and causal relationships between conventional and Islamic stock market returns under regime-switching framework

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Abstract

Purpose – This paper aims at examining the co-movement dependent regime and causality relationships between conventional and Islamic returns for emerging, frontier and developed markets from November 2008 to August 2020.

Design/methodology/approach – First, the authors used the Markov-switching autoregression (MS–AR) model to capture the regime-switching behavior in the stock market returns. Second, the authors applied the Markov-switching regression and vector autoregression (MS-VAR) models in order to study, respectively, the co-movement and causality relationship between returns of conventional and Islamic indexes across market states.

Findings – Results show the presence of two different regimes for the three studied markets, namely, stability and crisis periods. Also, the authors found evidence of a co-movement relationship between the conventional and Islamic indexes for the three studied markets whatever the regime. For the Granger causality, it is proved only for emerging and developed markets and only during the stability regime. Finally, the authors conclude that Islamic indexes can act as diversifiers, or safe-haven assets are not strongly supported.

Originality/value – This paper is the first study that examines the co-movement and the causal relationship between conventional and Islamic indexes not only across different financial markets' regimes but also during the COVID-19 period. The findings may help investors in making educated decisions about whether or not to add Islamic indexes to their portfolios especially during the recent outbreak.

Keywords Islamic index, Conventional index, Emerging markets, Frontier markets, Markov-switching regressions, MS-VAR model

Paper type Research paper

1. Introduction

The interdependence of international indexes has increased in recent years because of several factors such as globalization, removal of investment barriers, economic integration, financial

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innovation and technological advancement (Dewandaru *et al.*, 2014). In addition, one of the major effects of the recent financial crises is the increase of co-movement and correlations between assets. The COVID-19 economic recession, which is defined as a continuous significant global economic issue, is now affecting the world. This has been the biggest worldwide economic downturn since the subprime crisis of 2008 (Quinsee, 2020) [1].

Referring to recent studies, the economic effects of the COVID-19 pandemic are the main causes of this economic crisis (Baker *et al.*, 2020; Conlon and McGee, 2020; Corbet *et al.*, 2020; Kristoufek, 2020; Ramelli and Wagner, 2020; Zhang *et al.*, 2020). The first significant signs of the crisis appeared towards the end of February and persisted until the beginning of March. The rising number of COVID-19 cases and deaths has prompted concerns about the global economy because the global pandemic has frightened investors as well as the rest of humanity. In this sense, one of the major causes of the financial market collapse during the worldwide pandemic period can be attributed to the investors' worries and anxieties about the future (Erdoğan *et al.*, 2020a). The World Bank claims that a complete recovery will not be reached in some regions until 2025. By June 2021, the Bank group planned to mobilize more than$160 billion during a 15-month period to finance countries' responses to COVID-19 across a variety of new activities, reforming existing ones, activating disaster relief options and supporting competitive private sector strategies that facilitate restructuring and recovery [2]. Before the COVID-19 economic crisis, two other crises have characterized the last two decades: The Global Financial Crisis (GFC) of 2008–2009 and the European Sovereign Debt Crisis (ESDC) of 2010–2012. The interdependencies of financial markets across the world are once again being highlighted in the literature, as they were during the global financial crisis (Mun and Brooks, 2012). These volatile times have raised stock market correlations and have contributed to financial contagion and the increasing portfolio risk (Forbes and Rigobon, 2002). Hence, global investors look for other assets to diversify their portfolios by increasing returns while minimizing risk.

Among the alternative assets, the Islamic financial sector has grown very rapidly in the recent period. Islamic assets are a rising investment field on a global scale due to their reliability. One of the most important characteristics of the Islamic stock indexes is their adaptability in the face of financial crises (Erdoğan *et al.*, 2020b). Today, Islamic finance is considered a competitor of conventional finance. It is characterized as a credible alternative to conventional finance with less drift as its ethical sense and moral values would limit the danger of excessive speculation (Jawadi *et al.*, 2014). More options for investing have been offered by the advent of Islamic instruments (Abdul Hakim *et al.*, 2021).

As Islamic assets can be a good alternative investment that can offer high diversification benefits to investors, we care about co-movement and causal effects between returns of Islamic and conventional indexes in this study. It is well documented that the trade-off between risk and returns of Islamic stocks may be different from conventional stocks because the companies included in the Islamic indexes meet the extra-financial filter criteria, additional monitoring costs and a reduced investment universe (Saiti *et al.*, 2014). The knowledge of financial co-movement and causal relationships among Islamic and conventional indexes is important for the portfolio diversification. Understanding the connection of Islamic indexes with conventional ones helps investors to select a profitable strategy. It allows them to create a portfolio that produces more gains and minimizes losses by integrating and forecasting the connection between two indexes (Kim and Sohn, 2016; Rahim and Masih, 2016).

The main aims of the research are to identify the regime-dependent relationship by using Markov's regime-switching models. In fact, in financial literature, the results of integrating conventional and Islamic indexes were different. Due to the absence of unanimity, this question remains receptive to further empirical investigation. This situation motivates us to examine the co-movement and causality relationship between conventional and Islamic indexes across financial regimes from November 2008 to August 2020 in developed, emerging

and frontier markets. The methodology is built on Markov-switching regression and vector autoregressive (MS-VAR) models.

Our research differs from previous studies in several ways. First, we consider three indexes namely, MSCI emerging Markets; MSCI frontier Markets and MSCI developed Markets; which present three various types of markets with different characteristics. Second, we consider a recent period that includes the recent crisis of COVID-19. Third, we investigate not only the co-movement relationship between conventional and Islamic indexes but also the causal relationship during different market states. We attempt to capture the relationship between two types of indexes during stability and crisis regimes. This is made possible by applying various Markov-switching models. We use a two regime Markov-switching regression and Markov-switching autoregression.

The following sections are structured as below. Section 2 gives the literature review. Section 3 presents methodology and data. Section 4 deals with the discussion of the empirical findings. Section 5 brings the paper to a conclusion.

2. Literature review

Notwithstanding, there are various studies on the connection between conventional and Islamic indexes, researchers have found conflicting results. As an example, Abdul Karim *et al.* (2010) showed that Islamic indexes have not any cointegration by using thirty-two Islamic and thirty-two conventional indexes. Hakim and Rashidian (2002) used each cointegration and causality test to examine the links between Islamic and US Wilshire 5,000 indexes. They disclosed that the Islamic stock indexes are neither caused nor correlated by conventional indexes. Similarly, Ramasamy *et al.* (2015) established that conventional and Islamic indexes have not any cointegration connections by using a long-term diversification opportunity. Likewise, the research of El Amri and Hamza (2017) substantiated their hypothesis. Abu-Alkheil *et al.* (2017) stipulated that there is still no connection between the two different kinds of stock markets. In one of the primary studies, Albaity and Ahmad (2008) explored short and long-term associations of conventional and Islamic indexes in Malaysia from 1999 to 2005 using cointegration and causality tests. Their findings illustrated that the two indexes are trending in the same direction and tend to affect one another. The KLCI is also adapting to its long-term equilibrium, unlike the KLSI. Hammoudeh *et al.* (2014) investigated the structure of dynamic dependency between DJIM; represent Islamic index, three traditional indexes, as well as global risk variables. Throughout the years 1999–2013, they found a considerable relationship between DJIM, conventional indexes and world variables. Consequently, the idea of Islamic assets' independence from the traditional financial system was not supported. Similarly, Jawadi *et al.* (2015) demonstrated that emerging Islamic indexes are economically efficient only in the long term. The outcome confirms that Islamic markets might not be robust in hedging against traditional market shocks. These markets cannot offer considerable advantages of diversification for portfolio managers. Paltrinieri *et al.* (2019) analyzed dynamic correlations and cointegration by using conventional and Islamic indexes. They employed global indexes to look for reciprocal causality in co-movements. The findings revealed that a shock in global market volatility contains negative effects on all indexes across regions. Ben Rejeb (2017) and Ben Rejeb and Arfaoui (2019) stipulated that the Islamic indexes are not immunized against financial crisis effects. More Recently Abdul Karim and Abdul-Rahman (2020) investigated the Islamic and conventional stock market's integration in ASEAN-5. The authors used time series techniques of cointegration, VECM Granger causality and the GARCH (1, 1) model for the period from October 2009 to October 2019. The result confirms that those Islamic indexes are highly linked to their traditional counterparts.

Although the traditional approaches can be used to analyze the benefits of portfolio diversification, it does not take into consideration asymmetries such as crisis and non-crisis

periods. A growing number of publications support the idea of a return-behavior regime shift (Schaller and Van Norden, 1997; Li, 2007; Chen, 2008; Shen and Holmes, 2014; Li, 2007; Chen, 2008; Shen and Holmes, 2014). Using the two-state Markov-switching model, Aloui *et al.* (2015) demonstrated that Islamic stock indexes exhibit shifting features. As a result, the dynamic interaction between Islamic and conventional financial markets has changed throughout time. Buğan *et al.* (2021) used the Markov-switching augmented Dickey-Fuller (MS-ADF) test to look at market efficiency in global Islamic stock markets. Authors suggested that the Islamic stock market index has regime-switching features. The findings revealed that Islamic markets exhibit characteristics of two-state regime-switching. As a result, regime-switching models are more appropriate for studying this dynamic interaction. Therefore, we apply the Markov-switching regression and vector autoregression models to study the co-movement and causality relationships between Islamic and conventional stock return series across market states.

Ajmi *et al.* (2014) demonstrated a robust nonlinear and linear causality between two types of indexes. This finding backs up the theory that Islamic markets are decoupled from their traditional counterparts. Bahloul *et al.* (2017) investigated the volatility and returns influence of conventional indexes and macroeconomic variables on Islamic indexes' performance across financial regimes by using the Markov-switching regressions and MS-VAR model. The Markov-switching regression's findings proved that the conventional indexes and changes within the money supply had a considerable effect on Islamic indexes' performance in each high and low volatility regime. What is more, Granger's relation analysis offered the same results, particularly for the great effect of the conventional stock index return. Similarly, Cevik and Bugan (2018) used the Granger causality test under a regime-switching framework and impulse response analysis to investigate dynamic causality. The data showed that throughout periods of tranquility and crises, the Islamic stock index is influenced by its conventional counterpart. Thus, the suggestion that Islamic stock markets offer safe-haven properties and diversification benefits over financial crises is unsubstantiated. Buğan *et al.* (2022) examined the connecting relation between conventional and Islamic index returns. The authors examined Islamic financial markets' haven capacity throughout volatile times. They consider Islamic and conventional stock index returns to research their interactions. The causality-in-variance test reveals the total absence of a causal relationship, implying that Islamic markets give a restricted safe-haven opportunity. The findings suggested that emerging and the Islamic indexes have positive correlations, suggesting that they provide restricted portfolio diversification advantages.

The main goal of this article is to identify the regime-dependent relationship by using Markov's regime-switching models. The results of integrating traditional and Islamic indexes reported in previous studies were different. So, this question remains receptive to further empirical examination. Therefore, we checked this in our analysis of the co-movements and causality correlation between Islamic and conventional indexes through using Markov-switching regime models.

3. Methodology

In our research, we utilized a three-step methodology. In the beginning, we estimate autoregressive (AR) Markov change autoregressive (MS–AR) models to manifest the regime-switching behavior of return series. Within the second step, we apply Markov-switching regression models to study the co-movement relationships between the conventional and Islamic indexes for developed, emerging and frontier financial markets. Finally, we adopt the Markov-switching vector autoregression model (MS-VAR) to identify the Granger causality relation across market states.

3.1 Markov-switching autoregression model (MS–AR)

Goldfeld and Quandt were the first to create the Markov-switching model in 1973. Hamilton, then, introduced the autoregressive model in 1989 through providing an in-depth analysis as well as an estimating procedure. During this section, we tend to estimate the autoregressive (AR) and also the Markov-switching autoregression (MS–AR) models with lag order p, for all-time series returns. We use the Akaike Information Criterion (AIC) to pick out this lag order. Then, we tend to test the null hypothesis of linearity against the hypothesis of non-linearity using the likelihood ratio (LR) test. The AR (p) model can be written as follows:

$$r_t = \mu + \sum_{j=1}^{p} \beta_j r_{t-j} + \varepsilon_t \tag{1}$$

The MS–AR (p) model with two states is presented as follows:

$$r_t = \mu + \sum_{j=1}^{p} \beta_j r_{t-j} + \sigma(s_t)\varepsilon_t \quad s_t = 1.2 \tag{2}$$

For the AR (p) and MS–AR models, r_t is stock index return at time t. μ is a constant and r_{t-1}, $r_{t-2} \ldots r_{t-p}$ are lagged stock index return. β_j are the autoregressive coefficients and ε_t is an independent and identically distributed random variable with zero means and variance σ_ε^2. In the MS–AR model, σ depended on the regime s_t at time t. s_t is an unobservable random state variable taking the value one or two and follows a first-order Markov chain with the next transition probability matrix:

$$P = \begin{bmatrix} \Pr(s_t = 1|s_{t-1} = 1)\Pr(s_t = 2|s_{t-1} = 1) \\ \Pr(s_t = 1|s_{t-1} = 2)\Pr(s_t = 2|s_{t-1} = 2) \end{bmatrix} = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} \tag{3}$$

where p_{ij} $(i, j = 1, 2)$ is transition probabilities of $st = j$ when $st - 1 = i$, $p_{11} + p_{12} = p_{21} + p_{22} = 1$. The likelihood ratio test of the null hypothesis of a linear model against the alternative of the regime-switching model is presented as follows:

$$\mathrm{LR} = 2\ (\ln L_{\mathrm{MS-AR}} - \ln L_{\mathrm{AR}}) \tag{4}$$

We adopt Gracia (1998) critical values to choose the best-fitted model.

3.2 Markov-switching regression model

The effect of explanatory variables becomes state-dependent when using the Markov-switching regression model. This approach permits the regression parameters β_j to take different values in harmony with the market regime at the time t, which is noted by S_t. The Markov-switching regression model for Islamic indexes can be presented as follows:

$$R_{\mathrm{islam},t} = \mu + \beta_{1,s_t} R_{\mathrm{Conv},t} + \varepsilon_{t,st} \tag{5}$$

where R_{islam} and R_{Conv} are returns of Islamic and conventional stock index, respectively.

3.3 Markov-switching vector autoregression model (MS-VAR)

The point of this part is to look at the link between Islamic and conventional indexes. The Granger causality test (Granger, 1969) is a suitable approach to investigate this effect. We concentrate on the bidirectional causal relation among Islamic index and their conventional counterparts under a regime-switching framework. Therefore, we perform a bivariate

MS-VAR model. The MS-VAR, which was introduced by Krolzig (1997), is a multivariate generalization of the univariate model of Hamilton (1989), to detect causality under regime shifts. MS-VAR model is presented as follows:

$$R_{\text{islam}(t)} = \mu_1 + \sum_{j=1}^{p} a_{jS_t} R_{\text{islam}_{(t-j)}} + \sum_{j=1}^{p} b_{jS_t} R_{\text{Conv}_{(t-j)}} + \varepsilon_{1t} \quad (6)$$

$$R_{\text{Conv}_{(t)}} = \mu_2 + \sum_{j=1}^{p} c_{jS_t} R_{\text{islam}_{(t-j)}} + \sum_{j=1}^{p} d_{jS_t} R_{\text{Conv}_{(t-j)}} + \varepsilon_{2t}$$

Where R_{islam} is the monthly return of the Islamic stock index and R_{Conv} is the monthly return of the conventional index. ε_{it} is a white noise process with zero means and regime-dependent variance. p indicates the lag order determined by AIC. The basic idea of Granger (1969) for describing causality between two variables, R_{Conv} and R_{Conv} is: We can conclude that R_{islam} Granger causes R_{Conv} in a particular regime if one of the b_j (for $j = 1 \ldots p$) in that regime is significantly different from zero and R_{Conv} Granger causes R_{Conv} in a specific regime if one of the c_j (For $j = 1 \ldots p$) in that regime differs significantly from zero.

4. Data and descriptive statistic

The sample of our study contains three Islamic indexes, namely: the MSCI World Islamic Index [3], the MSCI Emerging Markets Islamic Index [4], and the MSCI Frontier Markets Islamic Index [5] and their conventional counterparts. To provide a complete study; we chose the three major indexes that represent the different types of markets. In recent years, frontier and emerging markets have offered some of the most attractive international investment prospects. These markets have been characterized by continuous economic growth over the past decade. This growth has improved the infrastructure of frontier and emerging countries and has also empowered financial markets which were previously almost entirely dependent on the global economy. These markets have also been characterized by a constantly increasing GDP per capita and by significant changes in the political structure of the country which has been favored by the opening up to globalization. The latter has helped emerging and frontier markets to join the import and export industry and to flourish rapidly. As a result, the price fall of financial assets, combined with the prospects of considerable long-term capital gains, have attracted a large number of investors wishing to diversify their portfolios.

Consequently, we collected 140 monthly stock market price observations in US dollars from November 2008 to August 2020 [6]. This period included extreme market fluctuations such as the 2008–2009 global financial crises (GFC), the 2009–2012 Eurozone debt crises (EZDC), and, most recently, the COVID-19 recession (March 2020). This period provides an excellent picture of the history of index returns because it spans many business cycles. Our sample period covers major international events such as the extreme market movements around the Global Financial Crises (GFC) of 2008–2009, the Eurozone Sovereign Debt Crises (EZDC) of 2010–2012 and recently the COVID-19 crisis (March 2020).

Throughout the empirical study, the monthly return series is produced by calculating the difference in the logarithm of two successive prices. Figure 1 illustrates the history of conventional and Islamic monthly index prices for three markets.

Table 1 reports the descriptive statistics for all monthly return series. With the exception of the frontier stock index, the monthly means of every return series is positive and it varies between 0.0044 and 0.0071. Whereas the highest mean return occurs in developed conventional index, the frontier Islamic index yield the lowest mean returns. Furthermore, the emerging Islamic stock return demonstrates higher volatility. Jarque-Bera test demonstrates that market returns deviate significantly from normality. For each market,

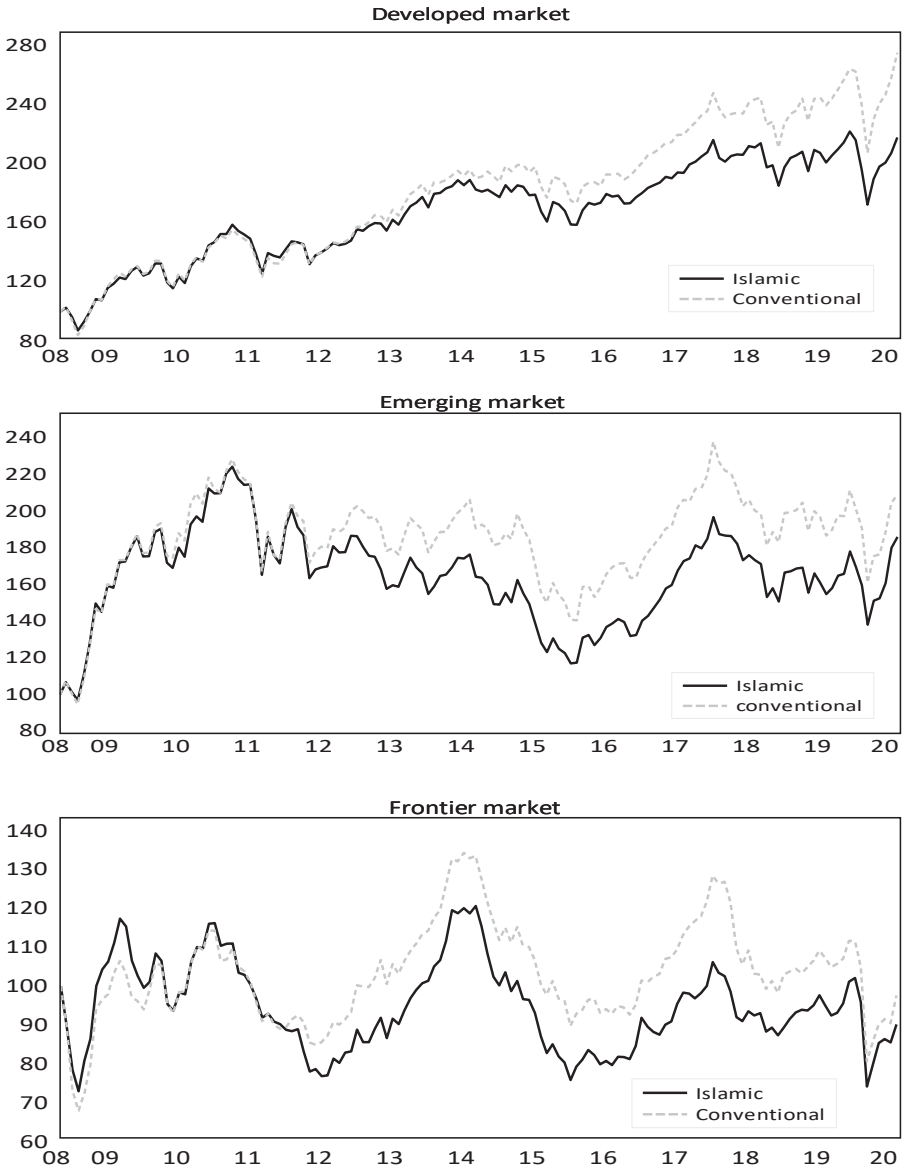

Figure 1.
Stock Market prices of Islamic and conventional indexes

the ADF computed value is below the crucial threshold at 1% confidence level. This indicates that all series are stationary.

5. Results and interpretation

5.1 Regime-switching test results

To confirm the presence of regime change, we estimate the linear autoregressive (AR) and Markov-switching autoregression models (MS–AR) with two regimes for Islamic traditional

	Mean	Std. Dev	Skew	Kurt	JB (*p*-value)	ADF (*p*-value)
Panel A: Islamic indexes						
Developed markets	0.0055	0.0420	−0.5461	3.7676	10.471 (0.00)*	−8.4129 (0.00)*
Emerging markets	0.0044	0.0563	0.5357	3.7523	9.9995 (0.00)*	−8.5324 (0.00)*
Frontier markets	−0.0007	0.0483	−1.0292	7.9751	170.311 (0.00)*	−10.9593 (0.00)*
Panel B: Conventional indexes						
Developed markets	0.0071	0.0439	−0.6340	3.9915	15.2249 (0.00)*	−9.2515 (0.00)*
Emerging markets	0.0052	0.0561	0.4730	3.7740	8.7167 (0.00)*	−8.5794 (0.00)*
Frontier markets	−0.0001	0.0493	−1.4056	9.8765	324.2393 (0.00)*	−10.6141 (0.00)*

Note(s): This table presents basic statistics of monthly returns for Islamic indexes and their conventional counterparts. The study's period is from November 2008 to August 2020. The Jarque-Bera normality test is abbreviated as JB. ADF is the Augmented Dickey-Fuller unit root test proposed by Dickey and Fuller (1981). The ADF test is conducted with time trends and constant. "*" Denotes that null hypothesis of normality or non-stationarity test is rejected at 1 percent level

Table 1.
Descriptive statistics

indexes. The ideal lag order is chosen with AIC. After estimating the two models, we used the likelihood test to figure out whether a regime transition has occurred or not.

Table 2 shows a strong rejection of the null hypothesis in the return series. The critical value of Garcia is equivalent to 17.52, 13.68 and 11.88 for the significance levels 1, 5 and 10%, respectively. The obtained likelihood ratio values are all higher than these critical values. They have ranged from 248,344 (for emerging markets) to 498,830 (for developed markets) for Islamic indexes. They have oscillated from 252,128 (developed markets) to 338,216 (for frontier market) for conventional indexes. These findings reveal the non-linearity of conventional and Islamic index returns. Therefore, the Markov-switching autoregressive models (MS–AR) is more suitable for describing Islamic stock markets' performance in comparison to their traditional counterparts. We use the two-state MS model used by Aloui *et al.* (2015), Bahloul *et al.* (2017), Cevik and Bugan (2018) to study the relationship between conventional and Islamic indexes.

In order to identify the regimes, we used both smoothed transition probabilities and estimated coefficients. Figure 2 illustrates the smoothed transition probabilities of Islamic index in developed, emerging and frontier markets [7]. They clearly demonstrate the distinction between stability and crisis regimes.

Table 3 reports the MS–AR model estimated for three markets. By looking at standard deviations, results confirm that they have been statistically significant at 1% level for developed, emerging and frontier markets. The MS–AR model estimation strongly indicated

	Log likelihood (two regimes)	Log likelihood (one regime)	Likelihood ratio
Panel A: Islamic indexes			
Developed markets	236.5028	211.5613	49.8830*
Emerging markets	190.0305	177.6133	24.8344*
Frontier markets	220.5570	206.5602	27.9936*
Panel B: Conventional indexes			
Developed markets	233.4712	220.8648	25.2128*
Emerging markets	191.1836	176.9338	28.4996*
Frontier markets	232.9385	216.0277	33.8216*

Note(s): The critical values of Garcia (1998) are 17.52 for $\alpha = 1\%$, 13.68 for $\alpha = 5\%$ and 11.88 for $\alpha = 10\%$. "*" indicates significance at 1% level

Table 2.
Regime switching test results

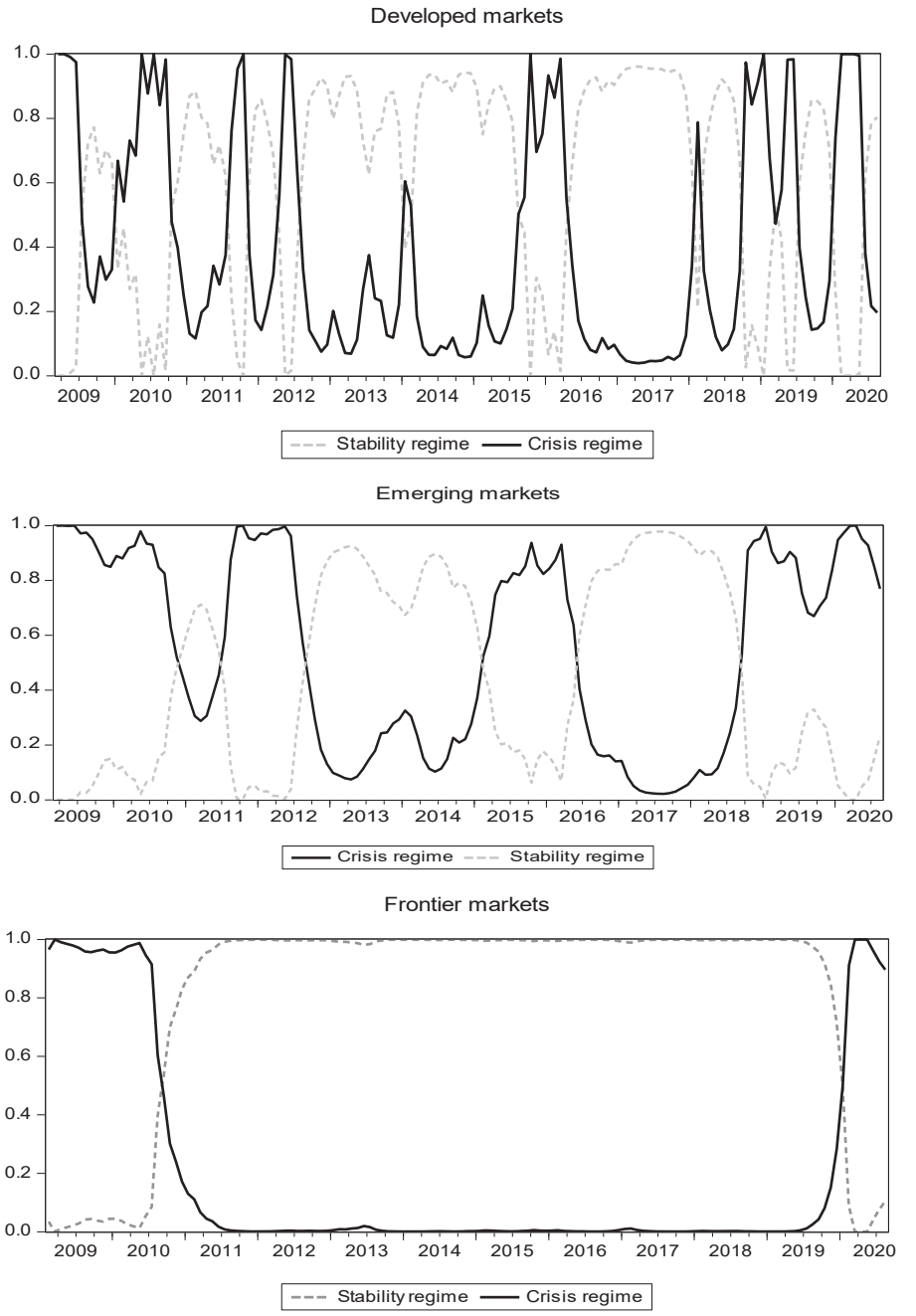

Figure 2.
Smoothed transition probabilities for Islamic indexes

Table 3. Estimation results for MS–AR model

	Developed markets		Emerging markets		Frontier markets	
	Islamic index	Conventional index	Islamic index	Conventional index	Islamic index	Conventional index
μ	−0.0001 (0.93)	0.0002 (0.84)	−0.0003 (0.89)	−0.0003 (0.87)	0.0002 (0.93)	−0.0001 (0.94)
AR(1)	−0.7754* (0.00)	−0.7575* (0.00)	−0.6569* (0.00)	−0.6915* (0.00)	−0.4674* (0.00)	−0.6093* (0.00)
AR(2)	−0.4722* (0.00)	−0.4649* (0.00)	−0.3821* (0.00)	−0.4304* (0.00)	–	−0.3641* (0.00)
AR(3)	−0.1920* (0.00)	−0.1617* (0.00)	–	−0.1338* (0.00)	–	−0.2407* (0.00)
Stability regime						
σ_1^2	0.0239* (0.00)	0.0238* (0.00)	0.0388* (0.00)	0.0409* (0.00)	0.0391* (0.00)	0.0379* (0.00)
Crisis regime						
σ_2^2	0.0671* (0.00)	0.0694* (0.00)	0.0778* (0.00)	0.0781* (0.00)	0.0985* (0.00)	0.1274* (0.00)
P_{11}	0.82	0.82	0.91	0.92	0.98	0.98
P_{22}	0.75	0.76	0.93	0.94	0.97	0.80
$E(d_1)$	5.52	5.56	11.52	13.74	62.40	44.87
$E(d_2)$	4.01	4.17	15.70	18.72	38.10	4.96
Log(L)	236.5028	233.4712	190.0305	191.1836	220.5570	232.9385

Note(s): $E(d_1)$ and $E(d_2)$ are the expected duration of regime 1 and regime 2, respectively. p-Values are in parentheses. "*"Denotes significance at 1% level

the presence of two different regimes. The 1st regime represents the stability regime characterized by low volatility while the 2nd regime represents the crisis regime characterized by high volatility. The crisis regime's variance is two times higher than the variance of the stability regime in all stock markets. Apart from emerging markets, Islamic indexes have the highest volatility level as compared to their conventional counterparts in a low volatility period. We have a different scenario for the high volatility period. Islamic indexes demonstrate the lowest volatility level for developed and frontier markets**.** The probability of being in a precise regime is also presented in Table 3. For developed and frontier markets, the probability of stability regime is always higher than the probability of staying in the crisis regime. The reading of these probabilities (P_{11} and P_{22}) indicates that the low volatility regime is more persistent than the high volatility one. While, for emerging markets, findings reveal that the crisis' regime is more persistent than the stability's regime. This shows that the emerging market indexes are more volatile than developed and frontier markets' indexes. According to Ng (2000), regional and other factors like cultural and religious factors are major causes of the market crisis.

Furthermore, the expected duration of months for each regime ($E[d_1]$ and $E[d_2]$) fully confirms the two regimes' persistence. Indeed, the expected duration of the low volatility regime lasts, on average, from 5.52 months to 62.40 months in developed and frontier markets, respectively. For Islamic indexes, it ranges from 5.56 to 62.40 in the same markets previously cited for conventional indexes. In contrast, the expected duration of the high volatility regime ranges from 4.01 months in developed markets to 38.10 in frontier markets for Islamic indexes and from 4.17 to 18.72 months in the emerging market for conventional indexes.

5.2 Markov-switching regression results

After detecting the existence of a regime behavioral change in all the studied return series, we estimate the Markov-switching regression model to identify the co-movement relationship between conventional and Islamic indexes across market states.

As seen in Table 4, the coefficients of the Markov-switching regression model estimation are all significant for both regimes. Looking first at conventional index returns, the coefficients (R_{conv}) are positive in two regimes and for three markets. Furthermore, the calculated coefficients have decreased in the crisis period for not only developed bust also frontier markets. Whereas, for the emerging market, this coefficient went from 0.9506 (during the stability period) to 10,991 (during the high volatility period). Accordingly, over periods of high volatility, the impact of conventional indexes is higher in the emerging market. However, this is not the situation in developed and frontier markets. Our findings are in accordance with previous research such as Bahloul *et al.* (2017) who emphasized the substantial influence of the conventional indexes on Islamic index return in different financial periods. Naifar (2016) explained these findings because of the fact that Islamic index stocks are the subset of all mainboard stocks (excluding prohibited sectors) and well-recognized traditional indexes are the benchmarks which are used to create Islamic indexes. In addition, all Islamic indexes went through a stock selection process, which is called stock filtering depending on the scope of activities of firms and their financial ratios. Therefore, the findings proved that Islamic index returns have a positive relationship with conventional counterparts. The coefficient (R_{isl}) is higher during the high volatility regime than during the low volatility one for the developed market. From Table 4, we recognize that the predictable coefficients verify the influence of Islamic indexes on a conventional index performance. This impact decreased significantly at the crisis regime for frontier and emerging markets. This reveals that co-movement relationship among conventional and Islamic indexes is weaker during the crisis, especially in frontier markets. The emerging market contains Malaysia, the Arab States Turkey and Indonesia where Islamic finance is well developed. Reuters (2020) [8]

Table 4. Estimation results of Markov-switching regression model

	Developed markets		Emerging markets		Frontier markets	
	R_{islam}	R_{conv}	R_{islam}	R_{conv}	R_{islam}	R_{conv}
μ	−0.00002 (0.93)	0.0005 (0.50)	0.0001 (0.91)	−0.0016 (0.00)	−0.00007 (0.92)	0.0002 (0.93)
Stability regime						
R_{islam}	–	0.9243*** (0.00)	–	1.0112*** (0.00)	–	0.9375*** (0.00)
R_{conv}	0.9794*** (0.00)	–	0.9506*** (0.00)	–	0.9951*** (0.00)	–
σ_1	0.0085*** (0.00)	0.0043*** (0.00)	0.0113*** (0.00)	0.00003*** (0.00)	0.0157*** (0.00)	0.0156*** (0.00)
Crisis regime						
R_{islam}	–	1.0401*** (0.00)	–	0.9848*** (0.00)	–	0.8980*** (0.00)
R_{conv}	0.9159*** (0.00)	–	1.0991*** (0.00)	–	0.7949*** (0.00)	–
σ_2	0.0149*** (0.00)	0.0129*** (0.00)	0.0158*** (0.00)	0.0137*** (0.00)	0.0293*** (0.00)	0.0321*** (0.00)
P_{11}	0.95	0.58	0.91	0.54	0.95	0.96
P_{22}	0.93	0.85	0.74	0.98	0.92	0.91
$E(d_1)$	24.71	2.38	11.32	2.20	24.80	26.82
$E(d_2)$	16.13	7.04	3.89	86.64	13.51	12.31
Log(L)	432.8923	428.5851	406.4482	413.2027	345.7921	345.9299

Note(s): $E(d_1)$ and $E(d_2)$ are the expected duration of regime 1 and regime 2, respectively. p-Values are in parentheses ***Denote significance at 1% level

reported that Malaysia is the top country when it is concerned to Islamic finance's improved performance, with such Global Islamic Economic Indicator (GIEI) score of 111 and an Islamic Finance Development Indicator (IFDI) score of 132 (*Islamic Finance Development Report* [2018]) [9]. Saudi Arabia was also placed fourth among the highest Islamic finance economies in the 2018 global Islamic economic report, with a GIE indicator score of 54, but Turkey was included in the top 15 countries with only a GIE indicator score of 31 (State of Global Islamic Economy Report, 2018/19, 2018) [10].

Consequently, the Islamic financial industry's significant success in Saudi Arabia, Malaysia and Turkey explains the reduction in crisis-related impacts. As noted previously, the MSCI frontier markets consist of 28 countries, which we find in Muslim countries, such as Jordan, Kuwait, Bahrain, Morocco, Tunisia . . . This may explain why the co-movement is less marked between Islamic indexes and their conventional counterparts in frontier financial markets. Results allowed us to prove that the Islamic index will not be able to give important benefits to investors in emerging, frontier and developed markets during both regimes. This demonstrates that Islamic stock markets have not succeeded in escaping the crisis's effects. Therefore, Islamic indexes cannot be exploited as a hedge or a haven for conventional indexes for portfolio management.

5.3 Granger causality test results

We estimate the MS-VAR model with two regimes to examine the causal relationship among Islamic and conventional indexes for three markets. With similarity to the linear MS–AR model, we adopted the information criterion AIC to select the optimal lag length of the model.

The outcomes of the MS-VAR model estimate are shown in Table 5. According to these results, the first regime's variances are lower than the second regime's ($\sigma_1 < \sigma_2$). We conclude that regime 1 is a stable regime characterized by low volatility and regime 2 is a crisis regime with high volatility. We consider first the unidirectional causation results from conventional to Islamic indexes. For both developed and emerging markets, findings demonstrate that Granger's causality extends from the returns of the conventional index to returns of the Islamic index only during the time of stability. Therefore, we noted the disappearance of significant links during times of financial crisis for these markets. According to Cevik and Bugan (2018), the causal relationship between the conventional and Islamic indexes is due to the causal interaction among financial markets which is related to their size. The Islamic financial system's total assets have reached $1.9 billion; the market capitalization of conventional equities markets has surpassed $36 trillion. Similarly, conventional financial markets are 18 times larger than Islamic markets. Hence, the causal link can be expected to shift from conventional index to Islamic index. Such main evidence is beneficial to market investors to predict the reaction of Islamic indexes to their counterparts' movement and contrariwise.

When it concerns the frontier markets case, we noted that there is no causal effect in the Granger sense, either in the crisis phase or in the stability period. This conclusion is similar to the studies of Abdul Karim *et al.* (2010), Hakim and Rashidian (2002), Ramasamy *et al.* (2015), El Amri and Hamza (2017) and Abu-Alkheil *et al.* (2017).

For the second part of the analysis, we are focused on the unidirectional causality effect from Islamic indexes to conventional indexes. For emerging and developed markets, we observe that only the autoregressive variable of the Islamic index returns (Risl_t) is statistically significant during the stability market. So, the Islamic index's returns have a causal consequence of the conventional index's returns only during the stability regime. Then, for the frontier market, the stock market return's autoregressive parameters of the Islamic indexes are not significant in the stability and crisis regime. In this situation, we show that there is no causal influence in the Granger sense from Islamic to conventional indexes in both regimes.

Table 5.
Estimation results for MS-VAR model

	Developed markets		Emerging markets		Frontier markets	
	R_{islam}	R_{conv}	R_{islam}	R_{conv}	R_{islam}	R_{conv}
μ	0.0098*** (0.00)	0.0122*** (0.00)	0.0061 (0.00)	0.0070*** (0.00)	0.0042* (0.09)	0.0057** (0.02)
Stability regime						
$R_{islamt-1}$	0.8762** (0.04)	1.0574** (0.02)	0.9487*** (0.00)	0.6457** (0.02)	0.3334** (0.05)	0.2085 (0.15)
$R_{islamt-2}$	–	–	0.6012** (0.05)	0.5996** (0.05)	–	–
$R_{convt-1}$	−1.3965*** (0.00)	−1.5538*** (0.00)	−1.1512*** (0.00)	−0.8348*** (0.00)	−0.2766 (0.11)	−0.1707 (0.22)
$R_{convt-2}$	–	–	−0.8234*** (0.01)	−8514*** (0.01)	–	–
σ_1	0.0005*** (0.00)	0.0004*** (0.00)	0.0008*** (0.00)	0.0007*** (0.00)	0.0011*** (0.00)	0.0009*** (0.00)
Crisis regime						
$R_{islamt-1}$	−0.3696 (0.30)	−0.4711 (0.27)	−0.8461 (0.21)	−0.3003 (0.38)	0.8104 (0.21)	1.5331 (0.06)
$R_{islamt-2}$	–	–	0.2998 (0.42)	0.3152 (0.42)	–	–
$R_{convt-1}$	0.8331 (0.11)	0.9657 (0.09)	1.4617 (0.08)	0.9462 (0.15)	0.0455 (0.85)	−0.2958 (0.38)
$R_{convt-2}$	–	–	0.2437 (0.46)	0.325 (0.43)	–	–
σ_2	0.0018*** (0.00)	0.0021*** (0.00)	0.0017*** (0.00)	0.0016*** (0.00)	0.0062*** (0.00)	0.0064*** (0.00)
P_{11}	0.77		0.73		0.96	
P_{22}	0.60		0.36		0.69	
$E(d_1)$	4.36		3.80		32.00	
$E(d_2)$	2.56		1.56		3.30	
Log(L)	738.5659		720.0094		654.6465	

Note(s): R_{Islam} is the monthly Islamic index return; R_{conv} is the monthly conventional index return. $E(d_1)$ and $E(d_2)$ are the expected durations of regime 1 and regime 2, respectively. The p-Values are in parentheses. ***Denote significance at 1% level. **Denote significance at 5% level

6. Conclusion

This paper has examined causative relationships among Islamic index and their conventional counterpart using monthly data for three different types of markets from November 2008 to August 2020. As a technique, we firstly used the MS–AR model to find regime change behavior within the two sorts of stock indexes. Secondly, we utilized the Markov-switching regression models to test the co-movement relationship between the index's returns. Finally, we used the MS-VAR model to look at the bidirectional Granger causality test. Our findings strongly support the existence of two completely different regimes for three markets: stability and crisis states. For emerging and developed financial markets, according to Markov-switching regression results, we emphasized on a robust and statistically important link between two categories of index throughout each regime. Therefore, during the high volatility, markets for Islamic financial products do not give the impression to be completely resistant to the international crisis. The Granger-causation approach examines findings to see whether there is causality in both directions between traditional and Islamic index returns only during the stability period. This relationship disappeared throughout the crisis. We cannot verify the conventional relation that goes from Islamic indexes to conventional indexes or the opposite. Just for stability state, market investors will predict the short reaction of Islamic indexes to the movement of their counterparts and contrariwise. Within the case of frontier markets, the relationship's sort between index's return is a co-movement relationship rather than causality. Our findings prove that there's no causal impact within the Granger sense between indexes in each regime. Our finding, not like those of Abdul Karim *et al.* (2010), Hakim and Rashidian (2002), Ramasamy *et al.* (2015) and El Amri and Hamza (2017), refutes the nonexistence of relationships among conventional and Islamic indexes. It corroborates with Bahloul *et al.* (2017), Ajmi *et al.* (2014), Cevik and Bugan (2018) and Buğan *et al.* (2022) wherever returns on Islamic indexes are positively correlated with returns on traditional indexes. Our empirical findings reveal that including financial instruments of Islamic markets has restricted diversification and performance features for international investment. The repercussions of our findings are necessary for financial managers, hedgers and international investors. Understanding financial co-movement between stocks markets is necessary for portfolio diversification and management of risk. Our paper's most interesting finding is that the connection between Islamic index and their conventional counterpart is considerably important across regimes. As a consequence, there's no indication that Islamic financial markets are resilient to conventional markets throughout the phase of crisis. As an outcome, markets of Islamic finance are considered to offer a diversification remuneration which will be safe-havens throughout times of economic crises that cannot be empirically supported. Additionally, our findings are needed for policymakers, as empirical outcome suggests that choice criteria for Shariah might not be adequate to decoupling Instruments of Islamic finance from their counterparts and so authorities and policymakers ought to review Shariah selection rules.

Our research has various practical implications for traders, Islamic portfolio managers and policymakers in developed, emerging and frontier markets. The study can help traders to understand how information flows between Islamic and conventional indexes as two different types of indexes. It can also be used to evaluate the informational effectiveness of Islamic capital markets. It can provide more explicit insights into the volatility transmission between Islamic and conventional indexes. Also, it can measure the degree and stability of these innovations across time. To design an efficient hedging strategy, portfolio hedgers must first understand how the two markets are connected over time. It is widely acknowledged by policymakers that, from the perspective of financial stability, volatility transmission across Islamic and conventional markets in developed, emerging and frontier regions is critical for policymakers in the sense that it can be used to assess policy effectiveness.

Notes

1. https://am.jpmorgan.com/us/en/asset-management/gim/adv/insights/portfolio-insights/global-equity-views.
2. https://www.worldbank.org/en/about/annual-report/covid-response.
3. The MSCI Developed Markets index covers stock market indexes of 23 Developed Markets countries. And it is used as proxy for developed markets. https://www.msci.com/documents/10199/149ed7bc-316e-4b4c-8ea4-43fcb5bd6523.
4. The MSCI Emerging Markets index covers stock market indexes of 27 Emerging Markets countries. https://www.msci.com/documents/10199/c0db0a48-01f2-4ba9-ad01-226fd5678111.
5. The MSCI Frontier Markets index covers stock market indexes of 27 Frontier Markets countries. https://www.msci.com/documents/10199/f9354b32-04ac-4c7e-b76e-460848afe026.
6. Data are obtained from MSCI database.
7. The smoothest transition probabilities of conventional index are available on request.
8. Reuters, T. (2020), State of the Global Islamic Economy Report 2019/20 Thomson Reuters, DinarStandard, available at: https://www.salaamgateway.com/SGIE19-20
9. IslamicFinanceDevelopmentReport2018 (2018), Thomson Reuters, available at: https://www.smefinanceforum.org/post/Islamic-finance-development-report-2018.
10. State of the Global Islamic Economy Report 2018/19 (2018), Thomson Reuters, Dinar Standard, available at: https://www.salaamgateway.com/story/state-of-the-global-islamic-economy-report-201819-islamic-economy-marks-steady-growth.

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