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Diversification Benefits of Shari'ah Compliant Equity ETFs in Emerging Markets

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Keywords: *Emerging markets, Islamic assets, dynamic optimisation, ETFs*

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Abstract

Previous studies on the performance of Islamic finance and banking have been more comparative than experimental when it comes to the role and effect of Islamic (Shari'ah compliant) assets in a conventional setting. This paper investigates whether Shari'ah compliant exchange-traded funds (ETFs) have potential diversification benefits to a volatile portfolio of conventional investments in emerging markets. The results suggest that such assets not only improve the risk-adjusted returns of portfolios but also receive proportionally higher weight during crisis periods. Hence, institutional investors should consider the 'religion effect' when they manage their assets, given the evidence regarding the outperformance of Shari'ah compliant equity relative to their conventional peers.

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1. Introduction

There has been a considerable expansion worldwide in Islamic finance and banking over the last decade. According to Ernest and Young (2016), the Islamic banking sector has exponentially grown by over 47% since 2014. This is in line with the UK Trade and Investment (UK Trade and Investment, 2013) which reported that the total value of Shari'ah compliant assets has grown by 150% since 2006. There are two possible reasons behind this phenomenal growth. First, there is an increasing Muslim population which represents the main base of clientele for Islamic banks and Islamic investments. The Pew Research Centre's report (2015) on Religion and Public Life shows that Muslims represented 23.2% of the world's population in 2010 and are expected to represent 30% of the world's total population by 2050. Second, religion has a substantial effect on economics and investment according to Gay (1991) and Kuran (1993). Under the Islamic law (Shari'ah), any financial transaction or investment should adhere to the following standards: the prohibition of interest rate, avoidance of speculation and uncertainty (gambling), investment in permissible businesses and emphasising the necessity of asset-backed investments (Abdullah et al. 2007; Elfakhani et al. 2005; El-Gamal, 2000). Given these standards, many academics and practitioners would perceive Islamic assets (Shari'ah compliant investments) and Islamic banks as more stable financing alternatives, particularly after the global financial crisis (Al-Rifai, 2012; Lean and Parsva, 2012). This is when conventional markets were hit significantly due to excessive speculation, low-quality credit and toxic investments.

This perception of the relative stability of Shari'ah compliant assets motivates us to examine the viability of Shari'ah compliant exchange-traded funds (ETFs)[1] as an asset

[1] An ETF is a fund, investing in a basket of stocks, whose aim is to replicate a benchmark index; nevertheless, it can be traded as a stock itself.

alternative, to enhance the performance of a volatile portfolio comprising of emerging conventional ETFs. The issue we posit here is showcasing the diversification benefits of Shari'ah compliant ETFs in a volatile portfolio during the crisis and non-crisis periods. As our preliminary analysis shows[2], Shari'ah compliant ETFs are weakly correlated with emerging markets' ETFs and this may make them a good asset alternative to consider in the asset allocation. Also, the fact that such ETFs are easily tradable (as compared to Islamic indices) allows the proposed investment strategies to be practically feasible and attractive investment options to both institutional and retail investors (Crucio et al. 2004). Overall, the key features which make us select ETFs in our examination are risk diversification, liquidity and practicality.

Furthermore, emerging markets have been suffering from a significant economic turbulence due to the increased correlations/co-movements between them and developed markets (Balakrishnan et al. 2011) for some decades now courtesy of globalization (Stulz, 2005). Crises coming from advanced economies such as the pro-cyclical effects of quantitative easing (Hauner and Kumar, 2009; Lavigne et al. 2014; Fratzscher et al. 2018) and the European sovereign debt crisis had a considerable effect[3] on emerging markets' stability (Beirne and Fratzscher, 2013). In addition, regional economic shocks can be as strong as shocks from developed economies. For example, Park and Mercado (2014) study the causes of financial stress in emerging markets and show that shocks from developed and other emerging countries can have the same impact (and in some cases even more) on the domestic financial system as that of regional shocks. Hence, to our belief, investing in Islamic and ethical investments may help, in general, to reduce the negative impact of such correlation.

[2] For example, see Figure 1 in section 2 of the paper.
[3] Both events led to sudden large capital outflows from the emerging market economies (Kose et al. 2006; Moshirian, 2008)

This research is positioned in the existing literature about norm-restricted investing as argued by “the neglect effect hypothesis” by Hong and Kacperczyk (2009) and how it affects the performance of religion-restricted investments and other investments. When neglecting specific assets, investors limit their arbitrage opportunities, because of a set of constraints and risks (Shleifer and Vishny, 1997) and pay more for their discriminatory preferences arising from social norms (Becker, 1957). Also, Kuran’s (1995) theory of “preference falsification” proposes that cultural norms are economically inefficient. However, based on evidence proposed by Loewenstein et al. (2001) many empirical studies provide weak support for the above theories and prove that religious norms can have positive effects on stock markets. As Wang and Nguyen (2013) suggest, it is important to select diversified portfolios during financial crises and periods of high volatility, as contagion risk tends to be strongly present.

The existing literature has examined extensively the performance of Islamic assets relative to their conventional peers and two key arguments have become prevalent. The first advocates the advantage of considering Islamic assets in portfolio allocation, due to their lower risk and weak correlations with their conventional peers (Abdullah et al. 2007; Al-Zoubi and Maghyereh, 2007; Aka, 2009; Merdad et al. 2010; Hassan and Girard, 2011; Mansor and Bhatti, 2011; Milly and Sultan, 2012; Alam et al. 2013; Azmat et al. 2014). The second argument suggests that Islamic assets are not different from conventional assets and in sometimes they underperform their benchmark (Peillex et al. 2018). However, the studies above are comparative in nature and did not address the viability of Islamic assets in a portfolio optimisation exercise.

This study attempts to fill these gaps in the literature. First, we examine whether Shari’ah compliant ETFs improve the risk-adjusted returns of emerging market portfolios during the crisis and non-crisis periods. Our constructed portfolios have a mixture of three asset classes, namely (i) conventional equity, (ii) conventional fixed income and (iii) Shari'ah compliant. This builds further on the work of Naqvi et al. (2018) which compares Islamic and conventional mutual funds in Malaysia and Pakistan and includes two investment styles, that of equity and mixed allocation. Second, we test whether Shari'ah compliant ETFs can outperform emerging markets fixed-income securities during the period of initiating quantitative easing programmes. Standard finance theory suggests that the inherited risk in fixed-income securities is usually less than any form of equity (Cakir and Raei, 2007). However, Islamic scholars claim that the relative absence of interest rates in financing businesses makes Islamic assets less risky and more resilient during market downturns. To the best of our knowledge, our study empirically investigates this for the first time in the literature. Third, in terms of methodological contribution, this study adds to the wider literature in asset allocation and portfolio optimisation by investigating Shari'ah compliant ETFs' performance using a dynamic asset allocation framework. Prior studies about the diversification benefits of Islamic assets are comparative rather than experimental. Studies such as Azad et al. (2018), Majdoub and Mansour (2014) and Saiti et al. (2014) analyse correlations between Islamic and conventional equity indices and derive implications about spillover effects across developed and emerging markets. Other studies use static asset allocation and have not addressed the time-variability in correlations when performing portfolio optimisation (Arouri et al. 2013; Hassan and Girard, 2011; Hayat and Krauessl 2011). This study extends the analysis and compares the performance of dynamic asset allocation to that of a traditional static mean-variance strategy. As far as we know, this is new to the literature and attempts to provide conclusive results to the existing debate on this matter.

Our study includes a total of 17 ETFs; 13 conventional emerging ETFs and 4 Shari'ah compliant equity ETFs which mimic the allocation of MSCI emerging markets Islamic index, MSCI US Islamic index and MSCI world Islamic index. The constituents of the emerging market indices focus on multiple emerging regions such as MENA, Latin America, Asia Pacific and emerging Europe.[4] We study the performance of a mixed portfolio (conventional and Islamic ETFs) and a conventional portfolio (conventional ETFs only). To calculate the optimal portfolio composition, we consider the time variability in assets' correlations using a univariate GARCH with the symmetric Dynamic Conditional Correlation (DCC-GARCH). This approach makes the construction of portfolios more efficient during volatile periods when correlations between assets can change significantly (Engle and Colacito, 2006).[5] DCC models are extensively used in the literature for the estimation of conditional correlations (Colacito et al. 2011) and introduced the asymmetry element in large panel data (Cappiello et al. 2006; Jondeau and Rockinger, 2012; Kalotychou et al. 2014).

Previous studies that use copula models for estimating portfolio risk measures (Malevergne and Sornette 2003; Junker and May 2005; Kole et al. 2007) claim that copula models are better alternatives to the correlation-based models. The first study to compare copula models against more sophisticated correlation-based models is that of Weiß (2012). Weiß (2012) analyses the accuracy of Copula-GARCH model relative to the DCC model in estimating portfolio risk measures for 1500 portfolios. The study shows that the DCC model's ability to estimate portfolios' risk is significantly higher than that of the parametric, the Archimedean, the elliptical and the mixture copulas models. Also, the DCC model yielded a significantly higher percentage of portfolios with acceptable portfolio risk estimates. This is also corroborated by Chiang et al. (2015) who argue that the dynamics between stock and bond returns are expected to vary over time due to exogenous shocks.

[4] We need to stress on that the selected ETFs are not related to majority Muslim countries, which are mostly emerging markets, but they track Islamic indices

[5] We also use the Asymmetric Dynamic Conditional Correlation (ADCC-GARCH) model by Sheppard (2002). However, as the results do not vary significantly between the two, we only report the findings from the DCC-GARCH model.

Their study uses an asymmetric DCC model to derive the time-varying correlations, volatility clustering and the asymmetric effect of a negative shock on returns compared to a negative shock.

In this paper, we compare the results of our dynamic strategy to that of the static mean-variance strategy by Markowitz (1952). We further evaluate the overall portfolio performance using the modified-Sharpe ratio (Sharpe, 1994) as the latter takes into account the non-normality in emerging ETFs' returns.

In brief, our portfolio optimisation exercise shows that Shari'ah compliant ETFs reduce the portfolio risk for all sample periods and result in improved risk-adjusted returns under both dynamic and static optimisations. The Shari'ah compliant ETFs' role is more prevalent during the crisis period and receives a proportionally higher weight compared to the non-crisis period. The proportional wealth allocated to Shari'ah compliant ETFs drops significantly during the non-crisis period since fixed-income ETFs have favourable risk/return characteristics. Finally, dynamic asset allocation leads to lower modified Sharpe ratios compared to static asset allocation in all sample periods as aggregate shocks in stock market returns affect dynamic correlations in an asymmetric manner with fewer gains during periods of high market volatility.

The rest of the paper is organised as follows. Section 2 provides a brief overview of the prior literature on Islamic assets' diversification benefits and on the spillover effects across Islamic and conventional markets. Section 3 presents the data and defines the conditional correlation models as well as the portfolio optimisation and evaluation framework used in this study. Section 4 reports our empirical findings. Section 5 concludes.

2. Prior literature

Despite a large number of prior studies regarding the diversification benefits of Shari'ah compliant assets and their use as a hedging instrument against extreme events in developed and emerging markets, prior findings are rather mixed. One of the earlier studies in this field by Cakir and Raei (2007) reports an increased diversification advantage for investors who include Islamic bonds (Sukuk) in a portfolio of conventional fixed income securities (Eurobonds). As the authors argue, such a combination reduces significantly the Value at Risk (VaR) of the overall portfolio. Furthermore, using a static allocation strategy, Arouri et al. (2013) investigate the advantage of investing in Islamic assets in the US, Europe and the rest of the world before and after the global financial crisis, using various MSCI and FTSE indices. According to their results, Islamic assets' weights increased considerably after the global financial crisis resulting in an improved portfolio performance. In terms of stock market returns, Dow Jones Islamic indices appear to outperform their conventional counterparts especially during the period of the financial crisis across the Euro region. They argue that this is driven by the increasing linkage between Europe and areas where the development of Islamic finance initially originated in countries such as Qatar.[6]

In terms of dynamic modelling, using an asymmetric generalised dynamic conditional correlation (AG-DCC) model, Azad et al. (2018) examine whether Islamic equity could act as a hedge during tranquil and turmoil periods using major indices in developed and emerging markets. Their study provides statistically significant evidence that Islamic equity can provide a hedge to both emerging and developed markets in both normal and crisis period further corroborating the results of Jawadi et al. (2014) who show a similar picture during

[6] This was in line with previous studies such as that of Al-Khazali et al. (2013) who argue that Islamic indices dominate only in the European market.

bearish market conditions. In a similar manner[7], Majdoub and Mansour (2014) examine volatility spillovers across the US stock market and 5 Islamic emerging markets and find that both markets are weakly correlated with no spillover effects between them. Mwamba et al. (2017) further model financial tail risks for Islamic and conventional equity indices and suggest that Islamic equity represented by Shari'ah compliant Dow Jones stock index (DJIM) has a lower probability of price drops compared to conventional equity markets during turbulent periods. All these findings are in direct contrast to Saiti et al. (2014) who calculate dynamic correlations between the MSCI conventional and Islamic stock indices and conclude that Islamic markets do not offer any extraordinary diversification opportunities to the US-based investors. On the contrary, there are also numerous studies that report neither a difference in risk levels nor in risk-adjusted returns between Islamic and conventional investments (Hakim and Rashidan, 2002; Hayat and Krauessl 2011). More recently, Umar (2017) analyse the diversification benefits of Islamic equity using Dow Jones total return Islamic indices and their conventional counterparts representing the world, developed and emerging markets. Their study shows that long-term investors, who can invest in both Islamic and conventional equity, suffer from higher welfare losses from ignoring conventional equity relative to those from ignoring Islamic equity. This finding is also corroborated by Abu-Alkheil et al. (2017). However, Umar (2017) find that Islamic equity is a more desirable option in the short run- particularly in emerging markets- due to their higher Sharpe ratios.

Finally, a large strand of the literature concentrates on the issue of stock market co-integration between developed and Islamic countries (Marashdeh, 2005; Bley and Chen, 2006; Majid et al. 2007; Majid and Kassim, 2010). Recent studies particularly focus on testing the contagion and decoupling hypotheses. For example, Hkiri et al. (2017) analyse the

[7] Their study also adopts a dynamic approach by employing a multivariate GARCH framework with (i) Dynamic Conditional Correlation (DCC), and (ii) Constant Conditional Correlation (CCC).

daily volatility spillovers between Islamic and conventional equity indices in developed and emerging countries using a generalized VAR methodology proposed by Diebold and Yilmaz (2011). Their results show that Islamic equity provides a hedge for conventional indices during turbulent periods. This is also supported by Abu-Alkheil et al. (2017) who suggest that Islamic equity offers diversification opportunities for global investors due to the absence of co-integration between Islamic and conventional equity indices. Uddin et al. (2018) further test for integration, decoupling and diversification of Islamic and conventional equity in three regions (world, emerging market and Europe) and show that Islamic equity markets offer hedging and diversification benefits and can be utilised in conventional portfolio rebalancing.

Nonetheless, a large number of empirical studies report that Shari'ah rules are not restrictive enough to positively differentiate global Islamic equity indices from their conventional counterparts. Shahzad et al. (2017) check the validity of the decoupling hypothesis of the Islamic stock market from the conventional stock markets using a multivariate setting in developed countries only. They examine the vulnerability of Islamic equity to shocks from conventional equity and from global macro-finance factors such as the (VIX) volatility index, the uncertainty index of U.S. equity market, U.S. 10-year Treasury bond yields and the international crude oil price. Their findings indicate that Islamic equity is exposed to economic and financial shocks in conventional financial systems and do not offer a viable alternative for investors who wish to hedge against market instability. These results support prior literature showing that the returns of Islamic equity indices can interact significantly with conventional markets and be prone to adverse performance during periods of financial turmoil (Ajmi et al. 2014; Hammoudeh et al. 2014; Yilmaz et al. 2015; Rejeb, (2017). Peillex et al. (2018) expand on this point and investigate the factors which lead to return variability for (i) Islamic exchange funds (IEFs), (ii) conventional, and (iii) socially responsible funds. According to their findings, actively managing IEFs can lead to a return variability of 8% to 33%, depending on the geographical location of these emerging markets.[8] As a possible explanation, the authors suggest that the strict adherence to Shari'ah rules expose IEFs' fund managers to under-diversification risk, further pushing them to adopt a more reactive asset allocation approach. Hence, inefficient active portfolio management techniques could possibly explain the reported underperformance of Islamic equity relative to conventional equity and their benchmark.

3. Data and methodology

Data Description

The empirical analysis is based on 17 ETFs' daily prices obtained from Bloomberg.[9] The ETFs focus on three asset classes, namely (i) conventional equity, (ii) conventional fixed-income securities, and (iii) Shari'ah compliant ETFs. As shown in Table 1, we include 5 ETFs which represent equity in emerging markets in general, 4 ETFs represent regional emerging equity (Europe, Latin America, Africa and the Middle East, Asia Pacific), 4 emerging fixed income ETFs, and 4 Shari'ah compliant equity ETFs represent the world, USA and emerging markets. The ETFs track the performance of major indices (MSCI, FTSE, S&P and JP Morgan) and are traded in three of the largest international markets (UK, US, and Germany). Our selection of the data was restricted by the availability of relevant ETFs to the scope of this research. Most ETFs in our research are established during the global financial crisis.

Accordingly, the research sample spans over the period of 23-05-2008 to 24-07-2017, which

[8] The authors show that these IEFs are managed actively even if they appear to follow a passive management approach due to restricting speculative trading and short selling.
[9] The base currency for all ETFs is USD.

amounts to a total of 2308 daily logarithmic returns. This sample covers two crises: the global financial crisis and the European sovereign debt crisis. This helps us in examining the performance of Shari'ah compliant equity ETFs during crisis and non-crisis periods. We perform a subsample analysis and divide the full sample into two subsamples to avoid in-sample over-fitting and spurious results. The first sample represents the crisis period from 23-05-2008 to 31-05-2012, when extreme market movements happened around 2008–2009 global financial crisis (Rejeb, 2017; Abu-Alkheil et al. 2017; Shahzad et al. 2017) and the 2009–2012 European sovereign debt crisis (Chiang et al. 2015; Rejeb, 2017). The second sample represents the non-crisis period from 01-06-2012 to 24-07-2017.

[Insert Table 1 about here]

The descriptive statistics in Table 2 report several summary statistics for the returns of the selected ETFs. All daily returns in our sample are non-normally distributed and the Jarque Bera test for non-normality strongly rejects the null hypothesis of normal distribution for the 1% significance level. The Augmented Dickey-Fuller (ADF) test is significant for all ETFs and indicates that our data is stationary. Moreover, the Ljung box Q-statistics show that the squared daily returns are autocorrelated for all ETFs. This means that there is more predictability in conditional volatility than returns. This can be explained by the time-varying risk premia model or what is called volatility feedback.[10] The Shari'ah compliant equity ETF traded in the USA (ISDULN) has the highest return (followed by the Emerging Markets Bond for UK and Ireland (EEMBLN)), while Emerging Europe (GURUS) has the lowest return. Shari'ah compliant equity ETFs' volatility levels are not significantly different to that of the conventional emerging equity, while the Emerging Markets Bond ETF (EMBUS) has

[10] A study by Campbell and Hentschel (1992) shows that negative shocks in returns causes a larger increase in variance than that of positive shocks. This is because expected returns should be sufficiently high to compensate the investor for the increased volatility.

the lowest risk.

[Insert Table 2 about here]

Generally, regional conventional emerging equity ETFs are strongly correlated as shown in Figure 1. This can be intuitively explained by the general downturn in emerging markets due to capital withdrawals (Hauner and Kumar, 2009; Lavigne et al. 2014; Fratzscher et al. 2018) and the negative signals of the asset purchases programmes by the FED and the European central bank (Beirne and Fratzscher, 2013). Also, some the ETFs' top holdings are common in the major indices they are mimicking such as FTSE EM, MSCI EM and S&P EM.

Shari'ah compliant equity ETFs are weakly positively correlated to the conventional ETFs. This is caused by the process of equity screening that results in their top holdings been different to those of their conventional emerging equity ETFs counterparts. However, Shari'ah compliant equity ETFs are moderately correlated, due to similar top holdings. The correlations in the subsamples are similar to those in the full sample with a slight increase in positive correlation between Shari'ah compliant and conventional emerging equity ETFs.

[Insert Figure 1 about here]

In terms of our modelling approach, our main objective is to investigate whether Shari' ah compliant equity ETFs improve the risk-adjusted return of a volatile portfolio comprising emerging equity and fixed income ETFs during the crisis and non-crisis periods. In general, we examine two portfolios during each period: i) one that includes conventional emerging ETFs and Shari'ah compliant equity ETFs, and, ii) another portfolio that includes conventional emerging ETFs only. Below, we explain the steps of calculating 'minimum risk optimal portfolios' (optimal portfolio thereafter).

Dynamic optimisation

Using in-sample data (23/08/2008 to 31/05/2012), we use Engle's (2002) Dynamic Conditional Correlation (DCC) model to account for the time variability of assets' correlations, because the dynamics between ETFs are expected to vary over time due to exogenous shocks[11] (Chiang et al. 2015). This is estimated in the following two steps:

Step 1: Obtain the conditional variance $\sigma_{i,t}^2$ for each asset and the standardized errors $\varepsilon_{i,t}$. We fit the asymmetric GJR-GARCH[12] model developed by Glosten et al. (1993) using the following algebraic formulation:

$$\sigma_{i,t}^2 = \omega_i + \beta_i \sigma_{i,t-1}^2 + \alpha_i \varepsilon_{i,t-1}^2 + \psi_i \varepsilon_{i,t-1}^2 1A_{\{\varepsilon_{i,t-1} < 0\}},\ \ i = 1, \dots, n \qquad (1)$$

where,$1A$ is an indicator function which has value 1 if $\varepsilon_{i,t-1} < 0$ and 0 otherwise. In line with Fleming et al. (2001), we assume constant expected returns. A negative value of 'ψ' implies that periods with negative residuals would be immediately followed by periods of a higher variance compared to the periods of positive residuals. The coefficients of the GJR-GARCH should be restricted to ensure that the fit variances are always positive. In this case, these coefficients must be $\omega_i > 0$, $\alpha_i \geq 0$, $\alpha_i + \psi_i \geq 0$ and $\beta_i \geq 0$. The variance process will be stationary if the coefficient restrictions are satisfied and $\alpha_i + \frac{1}{2}\psi + \beta_i < 1$. Alexander (2001) notes that when the coefficients are diagonal matrices, each variance/covariance term follows a univariate GARCH model with the lagged variance/covariance terms and squares and cross products of the data become simpler (Ledoit et al. 2003).

Step 2: Compute the dynamic covariance matrix, given the conditional variances and the time-varying correlation matrix. The symmetric positive definite time-varying correlation matrix $R_t = \{\rho_{ij,t}\}_{i,j=1,\dots,n}$ is a $k \times k$ (where k is the number of assets) diagonal matrix and

[11] Our sample period witnesses the global financial crisis, quantitative easing and the European debt crisis.
[12] Earlier test for autocorrelations revealed that most of the assets' data have autocorrelation even at the first-difference of log-returns. Therefore, GJR-GARCH model is the most suitable method to be employed, because it helps us in capturing the asymmetric dynamics of conditional volatility after negative and positive shocks.

calculated from the normalized standardised errors $\varepsilon_{i,t}$ from Step 1. The correlation matrix is calculated using the Maximum Likelihood Estimator. [13] We then estimate H_t as the conditional covariance matrix using $D_t = \{\sigma_{i,t}\}_{i=1,\ldots\ldots,n}$ which is a $k \times k$ diagonal matrix with conditional standard deviations on the diagonal

$$H_t = D_t R_t D_t \tag{2}$$

Following the specification made by Engle (2002) and Engle and Colacito (2006), the correlation matrix is computed as:

$$R_t = diag(Q_t)^{-1/2}\, Q_t\, diag(Q_t)^{-1/2} \tag{3}$$

$$Q_t = (1 - \delta_1 - \delta_2)\overline{Q} + \delta_1(u_{t-s}u'_{t-1}) + \delta_2 Q_{t-1} \tag{4}$$

where, $u_t = D_t^{-1}\varepsilon_{it}$ is the standardized errors scaled by their conditional variance estimated in the first step, $\overline{Q}$ is the unconditional covariance of the standardized errors u_t, and Q_t is a $k \times k$ symmetric positive definite matrix. δ_1 measures the short-run persistence. If it turns significant, this indicates that the recent news has a bigger impact on conditional correlation. δ_2 represents the dynamic structure of conditional correlations. If it turns significant, this means that conditional correlations become more persistent which implies that joint ETFs shocks have longer lasting effects on the conditional correlations. We impose the non-negativity and stationarity restrictions $0 \leq \delta_1, \delta_2 \leq 1$, and $\delta_1 + \delta_2 \leq 1$.[14]

Given the dynamic covariance matrices from DCC, we calculate the optimal portfolios with

[13] As per, Engle and Sheppard (2001) determines the significance of correlation asymmetry by looking at the log-likelihood function estimated based on GJR-GARCH parameters: $LLF = \sum_{t=1}^{T}\left[-\frac{1}{2}\ln(2\pi) - \frac{1}{2}ln(\sigma_t^2) - \frac{1R_t^2}{2\sigma_t^2}\right]$

[14] We repeat step a and b using the Asymmetric DCC (ADCC) model developed by Sheppard (2002), to allow joint negative shocks to have a stronger impact on conditional covariance matrix than positive shocks of the same size. We specified the DCC model with multivariate normal (MVNORM) The results are similar to those generated by the DCC model.

and without Islamic assets.[15] We follow a buy-and-hold strategy and the portfolio optimisation is performed with the objective risk minimisation. We assume that portfolio weights are positive (no short-sales) and there is no risk-free asset. The investor we are targeting in this research does not need risk-free assets in the asset allocation. This is because, part of the portfolio is fixed-income in orientation; hence, risk-free rates are considered to be less important. Accordingly, the optimal portfolio weights are estimated using Otranto's (2010) optimal weight equation as follows:

$$w_{t+1|t} = \frac{\sum_{t+1|t}^{-1} \mu_{t+1|t}}{\iota_n' \sum_{t+1|t}^{-1} \mu_{t+1|t}} \tag{5}$$

Given the information on time, $\mu_{t+1|t}$ is the vector of expected returns, and $\Sigma_{t+1|t}^{-1}$ is the expected covariance matrix at time $t+1$.

Static (Constant Correlation) Optimisation

To tests the dynamic model specification, we estimate the optimal portfolios using a traditional mean-variance strategy (Markowitz, 1952) during the crisis and non-crisis periods to identify how the weights of Shari'ah compliant equity ETFs differ from those generated by the dynamic optimisation strategy. The portfolios are calculated recursively based on the realised unconditional correlations.

The performance of all portfolios is evaluated using the modified Sharpe ratio (Sharpe, 1994). Originally, the Sharpe ratio represents the return per unit of risk, where the unit of risk is the standard deviation of the returns. Sharpe ratio used to be useful when assets are normally distributed. However, in our research ETFs' returns are far from being normal and

[15] We run 100,000 iterations to calculate the optimal portfolio with minimum risk.

modified Sharpe ratio helps in correcting the Value-at-Risk, given the skewness and kurtosis of returns. Accordingly, the modified Sharpe ratio is mathematically formulated as:

$$\text{Modified Sharpe Ratio}_{\text{p}} =- \frac{\mu - R_f}{R_f - MVaR_p}, \quad (6)$$

The risk-free rate in our research is omitted and assumed to be zero, due to its small value and irrelevance in the portfolio allocation. The modified Value-at-Risk equals to

$$\text{MVaR}_{\text{p}} = \mu + \left[\mathcal{Z}_p + \frac{1}{6}(\mathcal{Z}_p^2 - 1)S + \frac{1}{24}(\mathcal{Z}_p^3 - 3\mathcal{Z}_p)K - \frac{1}{36}(2\mathcal{Z}_p^3 - 5\mathcal{Z}_p)S^2\right]\sigma \quad (7)$$

where, μ is the expected return, $\mathcal{Z}_p$ is the confidence level (i.e. 95%), S is skewness of returns, K is kurtosis of returns and σ is variance of returns respectively.

4. Empirical results

We estimate the covariance matrix for two portfolios (with and without Shari'ah compliant equity ETFs) over the entire sample period, during and outside the financial crisis. For each portfolio, we use the fitted GJR-GARCH model conditional volatilities to estimate the conditional correlations.

According to Table 3, the parameters for the DCC GJRGARCH model[16] are statistically significant at 1% and 5% levels. The results show that the dynamics between conventional ETFs are different when Shari'ah compliant equity ETFs are included in the portfolio. On the short-run, the absence of Shari'ah ETFs makes the impact of recent shocks on the

[16] The DCC is more parsimonious than the ADCC. We find a slight increase in the log-likelihood function (Akaike Information Criterion (AIC)) when the asymmetric parameter is added to the ADCC model. For robustness, we also use the Integrated GARCH (IGARCH) model to estimate the dynamic variance-covariance matrix. As this method yields similar results and optimal portfolios we do not report these findings for brevity.

conventional ETFs' conditional correlations bigger. For example, short-term volatility persistence has less impact on correlations between conventional ETFs in the presence of Shari'ah equity ETFs (0.13) in the crisis period. However, it increases to (0.17) in their absence. This can be due to the vulnerability of conventional emerging ETFs to shocks from regional and developed markets. The policies in emerging economies make them highly integrated with developed economies and dependent on foreign debt. According to Park and Mercado (2014), the restriction of capital flows as a precautionary action and the absence of precautionary measures against speculative attacks in emerging economies, lead to currency devaluation, instability in real interest rate, dramatic fall in international trade and delayed domestic debt payments.

On the long run, the results indicate that joint shocks in ETFs' returns do not change the dynamic structure of conditional correlations. The parameter value is similar for all samples, irrespectively of whether we include Shari'ah ETFs or not. These results have important implications for portfolios' performance.

[Insert Table 3 here]

Using the conditional correlations generated from the estimated DCC-GJRGARCH, we calculate the optimal portfolios with the objective of risk minimisation. In Table 4, the results show that the inclusion of Shari'ah compliant equity ETFs to the portfolio reduces its risk. More particularly, Shari'ah compliant equity ETFs' diversification benefits are more prevalent during turbulent market conditions. The risk of the portfolio with Shari'ah ETFs is significantly lower than that without Shari'ah ETFs during the crisis period (29.3% versus 51.22% respectively).

[Insert Table 4 about here]

Our results are consistent with those prior empirical studies which suggest that Islamic assets have the ability to hedge emerging market investments during extreme market movements (Jawadi et al. 2014; Hkiri et al. 2017; Azad et al. 2018; Uddin et al. 2018). A possible explanation for these findings is provided by Mwamba et al. (2017) who also find that Shari'ah complaint assets have a lower probability of negative shocks in returns compared to their conventional peers during periods of financial crisis. Moreover, Abu-Alkheil et al. (2017) argue that Islamic assets offer diversification benefits, because of the absence of cointegration between Islamic and conventional markets. However, our results are contrary to those reported by Saiti et al. (2014), Hammoudeh et al. (2014), Shahzad et al. (2017) and Peillex et al. (2018). Unlike these studies that only compare the correlation structures of Islamic and conventional markets, we contextualise the dynamic conditional correlations in a portfolio exercise to find whether Shari'ah equity ETFs can improve the portfolio's performance. Also, our use of DCC-GJRGARCH model with ETFs provides more stylised facts compared to market indices. This is because. ETFs' returns can incorporate more information about their variability, as they are actively traded, unlike indices which represent only a general market trend.

The results from static portfolio optimisation are similar to those calculated using a dynamic portfolio optimisation. According to Table 5, Shari'ah equity ETFs reduce portfolio's risk in all sample periods. Also, the proportional weight of Shari'ah equity ETFs is higher during the crisis period compared to the non-crisis one. This is due to their lower risk levels and their weak correlations with other ETFs in the portfolio. Following the literature about static asset allocation using Islamic assets, our results are in-line with Al-Khazali et al. (2013) and Arouri et al. (2013), which show that Islamic assets' weight increased after the global financial crisis and led to a better portfolio performance. This supports also corroborates Umar (2017) who finds that Islamic assets can offer short-term diversification benefits to emerging markets' investors.

[Insert Table 5 about here]

Under both strategies, we find that total Shari'ah equity ETFs' weight in the crisis period was significantly higher than in the non-crisis period (33% and 18% respectively). This can be justified by the dominance of fixed-income ETFs in all optimal portfolios, because of their higher return per risk, especially after the period of the financial crises. This is consistent with Cakir and Raei (2007). We also note that Shari'ah compliant equity ETFs outweigh conventional equity ETFs in all optimal portfolios due to their better risk/return characteristics.

The results from the evaluation of the portfolio performance using the modified Sharpe ratio show that Shari'ah compliant ETFs improve the risk-adjusted returns, using both dynamic and static strategies for all sample periods. The most significant effect of Shari'ah equity ETFs appears after the crisis period and for the full sample. This is in-line with Azad et al. (2018) and infers a long-term economic significance from investing in Shari'ah Equity ETFs because the return per unit of risk improves significantly for the mixed portfolio as compared to a portfolio with conventional ETFs only. Our findings also show that the modified Sharpe ratios for portfolios following the dynamic strategy are lower than portfolios calculated by the static strategy during the crisis period (0.0004 and 0.0034 respectively). This indicates that the volatility persistence affects negatively the dynamics of correlations; hence, adopting a dynamic asset allocation strategy in volatile markets can be costly to institutional investors.

5. Conclusions

This study examines whether adding Shari'ah compliant ETFs to a portfolio of emerging market assets can improve the overall risk-adjusted returns. Using ETFs data from a broad range of conventional emerging equity and fixed income securities alongside Shari'ah compliant equity representing World, US and emerging markets, we perform both a dynamic and a static portfolio optimisation for the period 2008 to 2017. What one can infer from our findings is that Shari'ah compliant equity ETFs can improve the performance gains for an institutional investor in emerging markets. The benefits of Shari'ah compliant equity ETFs in the portfolio appear more during turbulent market conditions. Hence, institutional investors should consider the religion effect when managing their assets, given the evidence regarding the outperformance of Shari'ah compliant equity relative to their conventional counterparts. However, caution is necessary when using dynamic strategies because they can be considerably costly to apply especially during periods of high volatility in the emerging markets.

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Table 1. Data description

	Ticker	ETF	Additional Information
General Equity EM	EEM: US	MSCI Emerging Markets	Tracks the MSCI TR emerging markets index, Inception 11/04/2003
	VWO: US	FTSE Emerging Markets	Tracks the FTSE emerging markets index. Inception 10/03/2005
	SPEM: US	S&P Emerging Markets	Tracks the S&P Emerging BMI index. Inception 23/03/2007
	IEEM: LN	MSCI Emerging Markets	Tracks the MSCI emerging markets index. Inception 21/11/2005
	EWX: US	Emerging Markets Small Cap	Tracks the S&P emerging markets under USD2 Billion index. Inception 16/05/2008
Regional Equity EM	GMF: US	Emerging Asia Pacific	Tracks the S&P Asia Pacific emerging BMI index. Inception 23/03/2007
	GAF: US	Emerging Middle East & Africa	Tracks the S&P Mid-East and Africa BMI index. Inception 23/03/2007
	GUR: US	Emerging Europe	Tracks the S&P European Emerging BMI Capped index. Inception 23/03/2007
	GML: US	Emerging Latin America ETF	Tracks the S&P Latin America BMI index
Fixed Income In EM Traded in US and UK	EMB: UD	Emerging Markets Bond (FINRA ADF)	Tracks J.P. Morgan EMBI Global Core index, Follows FINRA authority and automated system. Established on 15/02/2008. Invest in government and quasi-government bonds grade and high yield bonds.
	EMB: UP	Emerging Markets Bond (NASDAQ Intermarket)	Tracks J.P. Morgan EMBI Global Core index, traded in NASDAQ. Established on 05/07/2008. Invest in corporate bonds across sectors (industrials, utilities and financial companies) as well as in quasi-government bonds
	EMB: US	Emerging Markets Bond (NYSE)	Tracks the J.P. Morgan EMBI Global Core index, traded in NYSE, Inception 19/12/2007. Invest in government and quasi-government bonds grade and high yield bonds
	EEMB: LN	Emerging Markets Bond (for UK and Ireland Investors Only)	Tracks the J.P. Morgan Emerging Markets Bond Index Global Core Index. Inception 07/04/2008. Open only to investors from the UK and Ireland. Traded in the UK.
Shari'ah compliant equity from World, USA and EM	ISDW: LN	World Shari'ah compliant equity	Tracks the MSCI World Islamic index. Traded in the UK.
	ISDU: LN	USA Shari'ah compliant equity	Tracks the MSCI USA Islamic index. Traded in the UK.
	ISDE: LN	Emerging Markets Shari'ah compliant equity Traded in London	Tracks the MSCI Emerging Markets Islamic Index. Inception 10/12/2007. Traded in the UK.
	IUSE: GR	Emerging Markets Shari'ah compliant equity Traded in Germany	Tracks the MSCI Emerging Markets Islamic Index. Inception 25/03/2008. Traded in Germany.

Note: This table shows the selected ETFs categorised by their investment style and asset class (Conventional/Islamic) and reports the ticker name and information for each ETF. USs stands for the United States of America; LN stands for the London Stock Exchange; GR stands for the German Stock Exchange; and, EM stands for emerging markets.

Table 2. Distributional properties of daily returns (Full sample 23-05-2008 to 24-07-2017)

	Mean	Std.Dev.	Skewness	Ex.kurtosis	Jarque Bera	ADF test	Ljung box test
EEMUS	-0.0063	2.06	0.54	19.09	620.08***	-13.15**	76.95***
VWOUS	-0.0091	1.94	0.20	14.02	709.21***	-12.83**	47.39***
GMFUS	0.0065	1.74	0.18	8.47	1160.47***	-12.73**	42.24***
EWXUS	-0.0047	1.58	-0.27	8.37	746.57***	-11.74**	47.52***
GURUS	-0.0360	2.46	-0.26	10.56	100.64***	-12.82**	20.25**
SPEMUS	-0.0047	1.78	-0.32	17.13	1015.36***	-12.90**	23.04**
GAFUS	-0.0048	1.95	-0.07	7.94	442.86***	-13.68**	63.35***
GMLUS	-0.0250	2.11	-0.17	11.77	120.87***	-12.69**	16.09*
EMBUD	0.0055	0.73	-1.01	34.73	1532.47***	-13.57**	85.53***
EMBUP	0.0053	0.74	-1.38	35.10	1511.96***	-13.68**	93.10***
EMBUS	0.0054	0.72	-1.51	35.23	1502.19***	-13.56**	114.48***
EEMBLN	0.0172	0.76	-0.72	11.45	91.57***	-13.50**	31.80***
IEEMLN	0.0160	1.59	-0.26	10.70	346.11***	-12.73**	48.31***
ISDWLN	0.0078	1.25	-0.13	12.11	122.76***	-13.16**	54.26***
ISDULN	0.0190	1.17	-0.43	15.85	177.35***	-13.23**	86.75***
ISDELN	-0.0160	1.77	-0.43	13.62	18.51***	-12.79**	27.10***
IUSEGR	0.0009	1.58	0.07	8.55	569.62***	-12.66**	35.23***

Notes: Jarque Bera is a test statistic for the null hypothesis of normality. ADF is the Augmented Dickey-Fuller test for the null hypothesis of a unit root with 1% and 5% critical values. The truncation lag = 24 and a downward selection procedure based on the AIC is performed until there is no presence of autocorrelation. (*) indicates significance at 10% level; (**) indicate significance at 5% level, (***) indicate significance at 1% level.

Table 3. Estimated parameters for the DCC-GJR GARCH model

		DCC-GJRGARCH (C+I)		DCC-GJRGARCH (C)	
		Estimate	P-value	Estimate	P-value
Full Sample	δ_1	0.012	0.000	0.014	0.000
	δ_2	0.986	0.000	0.984	0.000
Crisis Period	δ_1	0.013	0.000	0.017	0.000
	δ_2	0.984	0.000	0.980	0.000
Non-Crisis Period	δ_1	0.013	0.000	0.024	0.050
	δ_2	0.975	0.000	0.936	0.000

Notes: This table presents parameter estimates for the DCC conditional correlation model. The values in this table are calculated based on equation (4). The full sample period is 23/05/2008 to 24/07/2017, crisis period is 23/05/2008 to 31/05/2012, and non-crisis period is 01/06/2012 to 24/07/2017.

Table 4. Estimated optimal portfolio with the objective of minimizing portfolio risk under the DCC- GJRGARCH model

		Full sample (C+I)	Full sample (C)	Crisis Period (C+I)	Crisis Period (C)	Non-Crisis Period (C+I)	Non-Crisis Period (c)
Conventional assets	**EEMUS**						
	VWOUS						
	GMFUS						
	EWXUS	4.53	5.95	7.24	13.82		
	GURUS		9.84	1.55	6.40	0.29	
	SPEMUS						
	GAFUS	6.60	10.17	6.69	11.62		
	GMLUS	2.88	4.57			2.43	14.35
	EMBUD	16.56	14.12	18.60	16.24	58.40	61.16
	EMBUP	10.94		5.68			
	EMBUS	4.46	32.08		19.45		
	EEMBLN	15.63	19.21	20.84	22.19	19.61	24.49
	IEEMLN	3.45	4.05	6.27	10.28	0.46	
Islamic assets	**ISDWLN**	9.40		12.23		0.46	
	ISDULN			9.57			
	ISDELN	11.57		4.26		9.98	
	IUSEGR	10.47		7.08		8.36	
	Total Weight	100.00	100.00	100.00	100.00	100.00	100.00
	Std.Dev.	26.91	43.78	29.38	51.22	12.6	20.82

Notes: This table presents the optimal weights under the dynamic portfolio strategy, using the conditional correlations obtained from the DCC model. The values in this table are calculated based on equations 1 to 5. All numbers are in percentage (%). (C+I) indicates portfolio of conventional and Islamic (Shari'ah compliant) assets. (C) Indicates portfolio of conventional assets only. StdDev Sharpe (Rf=0.1%, p=95%). The full sample period is 23/05/2008 to 24/07/2017, crisis period is 23/05/2008 to 31/05/2012, and non-crisis period is 01/06/2012 to 24/07/2017

Table 5. Estimated optimal portfolios with the objective of minimizing portfolio risk under static mean-variance model

		Full sample (C+I)	Full sample (C)	Crisis Period (C+I)	Crisis Period (C)	Non-Crisis Period (C+I)	Non-Crisis Period (C)
Conventional assets	**EEMUS**			2.80	0.40		7.60
	VWOUS		0.40	1.60	2.00		
	GMFUS		10.20		1.00		
	EWXUS		0.40	12.60		4.20	
	GURUS						
	SPEMUS	0.40		0.20			
	GAFUS	4.00	6.60			2.00	
	GMLUS		0.80				0.20
	EMBUD		15.00	3.60	2.00		51.00
	EMBUP	18.60		16.00	0.60	49.40	0.60
	EMBUS		21.00	9.00	34.80	0.80	
	EEMBLN	34.80	45.60	27.60	58.80	32.00	39.80
	IEEMLN	12.00		7.20	0.40	0.40	0.80
Islamic assets	**ISDWLN**	15.80		5.00		2.60	
	ISDULN	13.60		2.00		2.40	
	ISDELN			1.60		1.00	
	IUSEGR	0.80		10.80		5.20	
	Total Weight	100.00	100.00	100.00	100.00	100.00	100.00
	Std.Dev.	47.67	53.73	61.93	64.98	35.35	39.35

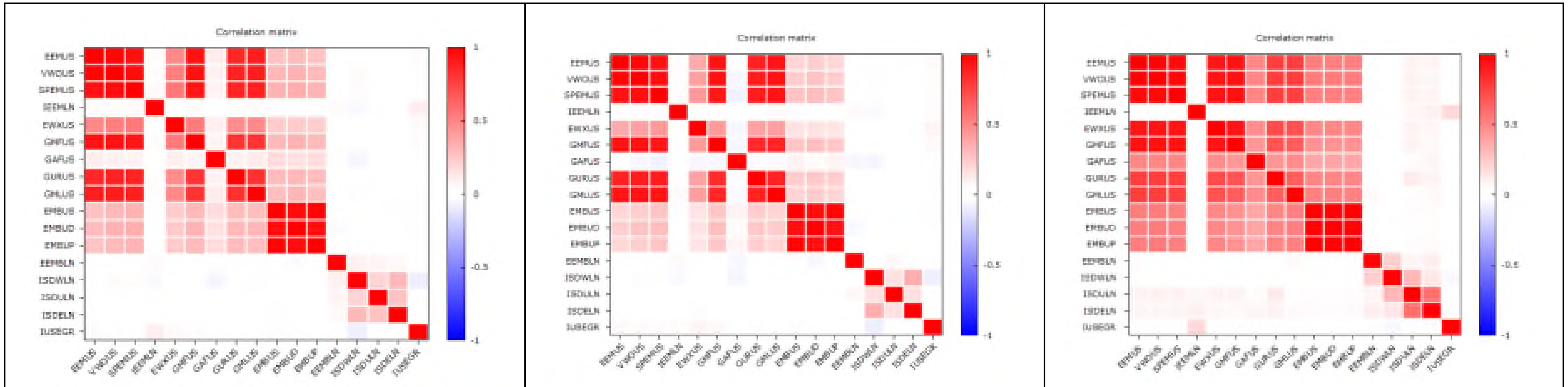
Notes: All numbers are in percentage (%). The table shows the optimal weights under the static Mean-Variance strategy for three research samples using daily data. The values in this table are calculated based on equation (5). The full sample period is 23/05/2008 to 24/07/2017, crisis period is 23/05/2008 to 31/05/2012, and non-crisis period is 01/06/2012 to 24/07/2017. (C+I) indicates portfolio of conventional and Islamic (Shari'ah compliant) ETFs, and (C) indicates portfolio of conventional ETFs only

Table 6. Performance evaluation of estimated portfolios using dynamic and static strategies: modified Sharpe Ratio (mSR)

	Dynamic DCC-GARCH	Static Mean-Variance
Full sample (C+I)	0.0209	0.0334
Full sample (C)	0.0090	0.0119
Crisis Period (C+I)	0.0004	0.0034
Crisis Period (C)	0.0002	0.0015
Non-crisis Period (C+I)	0.0329	0.0402
Non-crisis Period (C)	0.0190	0.0349

Notes: The table shows the modified Sharpe ratios for the optimal portfolios under the dynamic and static strategies for three samples, using daily returns. The values in this table are calculated based on equation (6). The full sample period is 23/05/2008 to 24/07/2017, crisis period is 23/05/2008 to 31/05/2012, and non-crisis period is 01/06/2012 to 24/07/2017. (C+I) indicates portfolio of conventional and Islamic (Shari'ah compliant) ETFs, and (C) indicates portfolio of conventional ETFs only

Figure 1. Unconditional static correlation matrix between conventional and Shari’ah compliant ETFs



Full Sample 05/2008-07/2017	Crisis Period 05/2008-05/2012	Non-crisis Period 06/2012-072017

Notes: This figure shows the strength and direction of correlations between the selected ETFs in this research. The red colour means positive correlation and the blue colour means negative correlation. A darker shade indicates stronger correlation between ETFs and vice versa.