Are Asian *Sharī'ah*-Compliant Equity Indices Predictable

*Muhammad Umer Quddoos
**Muhammad Shehryar
***Asif Yaseen

Abstract

This study examines the informational efficiency in the weak-form of Islamic (*Sharī'ah*-compliant) equity indices of selected countries by testing the Martingale Difference Hypothesis and the Random Walk Hypothesis. The study applies Automatic Portmanteau Test (AQ) and Automatic Variance Ratio Test (AVR) on daily index return from 1st July 2009 to 30th June 2018. All indices appear to be informationally efficient (weak-form) as per the AQ Test, except FTSE Malaysia EMAS *Sharī'ah* Index and Jakarta Islamic Index. As per results of AVR Test, Islamic indices of China and Malaysia were not found weak-form of efficient. Whereas, as per the combined results of both AQ and AVR Tests, it is found that only three indices rejected the weak-form of efficiency and five indices are consistent with weak-form of efficiency. So, it can be concluded that Asian Islamic indices have the sufficient level of tendency towards the informational efficiency in weak form. Findings of this study will help the academicians, regulators, and policy-makers understand the application of market efficiency hypothesis, and its major aspects that need further investigation.

Keywords: *Sharī'ah*-compliant equity indices, Efficient Market, Martingale Difference Hypothesis, Random Walk Hypothesis.

JEL Classification Numbers: G14, G15

Introduction:

After the severe wave of global Subprime Mortgage Crises (2007-2009), researchers and economists called for a new financial mechanism [1]. The Islamic Financial System (IFS) is based upon the principles of *Sharī'ah* (The code of conduct based on Islam). During the last many years, the Islamic financial services (e.g., Mudarabah, Musharakah, *Istīsnā'*, Salam, *Murabaḥā*, Takaful, *Ṣukūk*, etc.) have gotten immense attention, around the world, by *Sharī'ah*-complaint investors as well as by even non-muslim investors due to the Profit and Loss Sharing (PLS) modes of financing, adequate market discipline, and absence of derivatives which are missing in conventional financial system[2]. As PLS have merits/benefits over conventional[3]. Further, Siddiqi[4] concluded that the Global Financial Crises of 2007-2009

*(Corresponding Author), Assistant Professor, Department of Commerce, Bahauddin Zakariya University, Multan.
**Lecturer, Department of Economics & Business Administration, University of Education, Faisalabad Campus.
***Professor of Management, Department of Commerce, Bahauddin Zakariya University, Multan.

[1] M Umer Chapra, "The Global Financial Crisis: Can Islamic Finance Help Minimize the Severity and Frequency of Such a Crisis in the Future," in *A Paper Presented at the Forum on the Global Financial Crisis at the Islamic Development Bank On*, vol. 25, 2008.

[2] Chapra.

[3] Haitham A Al-Zoubi and Aktham I Maghyereh, "The Relative Risk Performance of Islamic Finance: A New Guide to Less Risky Investments," *International Journal of Theoretical and Applied Finance* 10, no. 02 (2007): 235–49.

[4] Mohammad Nejatullah Siddiqi, "Current Financial Crisis and Islamic Economics," *IIUM Journal of Economics and Management* 16, no. 2 (2008): 125–32.

collapsed the Capital Markets of well-developed economies as well the more stability of Islamic Banks during the era of Global Financial Crises. Recently, Global Islamic Finance Report 2017 (GIFR) mentioned that the "Global Islamic Financial Assets (GIFA) have reached to US$ 2.293 trillion at the end of 2016 with the growth rate of 7%, as compared to 7.3% in 2015 (GIFA US$ 2.143) and 9.3% in 2014 (GIFA US$ 1.981)". Accordingly, researchers e.g., Ho et al.[5], Al-Khazali[6], Setianto and Abdul Manap[7], Hassan et al.[8], Al-Khazali et al.[9], Charles et al.[10], Hassan et al.[11], Ali et al.[12], Badeeb and Lean[13] etc. investigated behavior, efficiency, and performance of different *Sharī'ah*-compliant investment products and services like *Sharī'ah* indices, Islamic equity funds, as well as Islamic bonds etc.

Literature Review:

In this part, different studies are discussed which contributed to the existing literature by investigating the Islamic indices (*Sharī'ah*-compliant) as well as conventional indices based on informational efficiency, portfolio diversification (co-integration), performance, and return and risk profile, etc.

Empirical Literature

Risk, Return and Performance:

Few studies have been done to determine the risk, returns, and performance of Islamic indices over the globe specifically in the Asia. For instance, Hakim and Rashidian[14] focused on to determine the risk and return profile of the *Sharī'ah* index and its conventional index. They chose the sample of DJIM (*Sharī'ah* index) and its conventional index, i.e., Wilshire 5000 index, and pointed out that the risk and returns of *Sharī'ah* index have distinctive characteristics as compare to the conventional index. Hussein and Omran[15]

---

[5] Catherine Soke Fun Ho et al., "Performance of Global Islamic versus Conventional Share Indices: International Evidence," *Pacific-Basin Finance Journal* 28 (2014): 110–21.

[6] Osamah Al-Khazali, Hooi Hooi Lean, and Anis Samet, "Do Islamic Stock Indexes Outperform Conventional Stock Indexes? A Stochastic Dominance Approach," *Pacific-Basin Finance Journal* 28 (2014): 29–46.

[7] Rahmat Heru Setianto and Turkhan Ali Abdul Manap, "Examining the Islamic Stock Market Efficiency: Evidence from Nonlinear ESTAR Unit Root Tests," *Indonesian Capital Market Review*, 2015.

[8] M Kabir Hassan, Omer Unsal, and Hikmet Emre Tamer, "Risk Management and Capital Adequacy in Turkish Participation and Conventional Banks: A Comparative Stress Testing Analysis," *Borsa Istanbul Review* 16, no. 2 (2016): 72–81.

[9] Osamah M Al-Khazali, Guillaume Leduc, and Mohammad Saleh Alsayed, "A Market Efficiency Comparison of Islamic and Non-Islamic Stock Indices," *Emerging Markets Finance and Trade* 52, no. 7 (2016): 1587–1605.

[10] Amélie Charles, Olivier Darné, and Jae H Kim, "Adaptive Markets Hypothesis for Islamic Stock Indices: Evidence from Dow Jones Size and Sector-Indices," *International Economics* 151 (2017): 100–112.

[11] M Kabir Hassan et al., "The Determinants of Co-Movement Dynamics between Sukuk and Conventional Bonds," *The Quarterly Review of Economics and Finance* 68 (2018): 73–84.

[12] Sajid Ali et al., "Stock Market Efficiency: A Comparative Analysis of Islamic and Conventional Stock Markets," *Physica A: Statistical Mechanics and Its Applications* 503 (2018): 139–53.

[13] Ramez Abubakr Badeeb and Hooi Hooi Lean, "Asymmetric Impact of Oil Price on Islamic Sectoral Stocks," *Energy Economics* 71 (2018): 128–39.

[14] Sam Hakim and Manochehr Rashidian, "Risk and Return of Islamic Market Indexes," in *Makalah Seminar Di Malaysia*, 2004.

[15] Khaled Hussein and Mohammed Omran, "Ethical Investment Revisited: Evidence from Dow Jones Islamic Indexes," *The Journal of Investing* 14, no. 3 (2005): 105–26.

identified the economic conditions, effects of industry, and size on DJIM returns to examine the performance of Islamic indices and reported that during bullish-market, Islamic indices outperformed conventional indices. Alam and Rajjaque[16] also measured the performance of the Islamic and conventional stock markets but the sample was European market. The statistical results of their study found and confirmed that, during the time span of general economic downturn, Islamic stock markets outperformed the conventional one. Further, their study also reported that risk of Islamic equities' portfolios is low and these indices showed higher robustness. So, keeping in view the above studies, it can be mentioned that these studies are very momentous and contributed an important part to the literature but ignored the important domain of Islamic indices, i.e., Market Efficiency, which is very vital and necessary for regulators as well as for investors to make good decisions. That is why, in the present study, it is of interest to study whether Islamic indices are moving towards the informational efficiency or not.

Moreover, some researchers focused on to comparatively examine the Dow Jones Islamic Index (*Sharī'ah*-compliant) and Dow Jones World Index (conventional) on the basis of risk performance[17] and as per the statistical results, their study pointed out that *Sharī'ah* index outperformed its conventional one on the basis of risk. They concluded that *Sharī'ah* index outperformed the conventional one because Islamic Finance has PLS principle. So, in this connection, this study also shows its interest in Islamic indices by examining the Asian own native Islamic indices, instead of institutional indices like Dow Jones Indices etc, on account of market efficiency. In addition, Ho et al.[18] claimed that during crisis, *Sharī'ah* indices performed better than their conventional ones, but one of the key shortcomings of these studies is that they ignored the main area of interest of market efficiency. That is why this present study is interested to know that whether *Sharī'ah* indices are informationally efficient or not.

Further, a study investigated the *Sharī'ah*-compliant equity funds as well as conventional ones on the basis of performance over the time period from 2000 to 2009[19] and concluded that Islamic equity funds under-performed compared to their conventional ones. As per the results of their study, they also found that instead of investing in Islamic equity funds, the performance of portfolio could be enhanced by investing in Islamic exchange-traded fund /Islamic index-tracking funds. So, keeping in view the above studies, it is found that Islamic indices and mutual funds showed better results in performance, risk, and return than conventional ones. Hassan et al.[20] examined the volatility-linkages and conditional correlation between *Ṣukūk* and conventional bond in the emerging markets, Europe, and United States by employing the Multivariate-GARCH methodology and found that *Ṣukūk* and conventional investment-grade bonds have a lower reaction of conditional volatility to market shocks and higher persistence. It has also found that *Ṣukūk* returns are much less volatile than U.S. and EU investment-grade bonds. Therefore, this study also focuses upon, and further explores, the

[16] Nafis Alam and Mohammad Shadique Rajjaque, "Shariah-Compliant Equities: Empirical Evaluation of Performance in the European Market during Credit Crunch," in *Islamic Finance* (Springer, 2016), 122–40.
[17] Al-Zoubi and Maghyereh, "The Relative Risk Performance of Islamic Finance: A New Guide to Less Risky Investments."
[18] Ho et al., "Performance of Global Islamic versus Conventional Share Indices: International Evidence."
[19] Raphie Hayat and Roman Kraeussl, "Risk and Return Characteristics of Islamic Equity Funds," *Emerging Markets Review* 12, no. 2 (2011): 189–203.
[20] Hassan et al., "The Determinants of Co-Movement Dynamics between Sukuk and Conventional Bonds."

different characteristics of Islamic indices by determining whether Asian Islamic indices are informationally efficient or not through examining the informational efficiency in the weak form over the time span from 2009 to 2018.

2.1.2 Market Efficiency:

A vital characteristic of any market is its level of informational efficiency and to what extent the securities' prices of the market reflect and incorporate the public information (current and historical) and private information (Insider). So, in this context, limited studies, especially in Asia, have been done in this area of interest as Guyot[21] rejected the null-hypothesis that Islamic indices are more efficient in weak-form than conventional ones. In addition, El Khamlichi et al.[22] also contributed to the literature by doing a comparative study on *Sharī'ah* indices and conventional indices on account of examining the informational efficiency (weak-form) and diversification potential. In their study, they used the daily prices of Morgan Stanley (MSCI), Financial Times (FTSE), and Dow Jones' Islamic as well as conventional indices for the time span from the day of starting to March 2011. For analysis, they applied the Variance Ratio for examining the weak-form of efficiency and Engle and Granger[23] co-integration technique to examine the diversification. Their study found that both *Sharī'ah* compliant and conventional indices have the similar tendency of inefficiency except MSCI and FTSE which have less level of inefficiency. Further, they also contributed that Dow Jones and Standard and Poor (SandP) were not co-integrated during the respective periods whereas MSCI and FTSE were co-integrated.

Moreover, Jawadi et al.[24] determined the informational efficiency (weak form) of three major *Sharī'ah*-Compliant equity for the time span of 2002-2012 including three sub-periods of 2002-2017, 2008-2009, and 2010-2012. This study applied the different parametric and non-parametric test for the short horizon as well as for long horizon to measure the efficiency. As per the results, this study found that developed Islamic stock market has more informational efficiency than emerging Islamic stock market. They also suggested, making the investment in this region, to diversify the portfolios in the short term as well as in the long term too. Alam et al.[25] adopted Multifractal De-trended Fluctuation Analysis to examine the informational efficiency of the sectoral equity indices. As per the statistical results, the study claimed that during the shorter sub-period, the *Sharī'ah*-Compliant and conventional indices have the similar efficiency level. Moreover, during the last decade, Islamic sectoral indices exhibited a higher efficiency in general. Overall, Islamic sectoral indices followed more to the weak-form of efficiency than conventional ones. So, in this context, this present study also attempts to examine the informational efficiency of Islamic indices in eight Asian countries i.e., Pakistan, China, Singapore, Japan, Singapore, Malaysia, Thailand, and Turkey.

---

[21] Alexis Guyot, "Efficiency and Dynamics of Islamic Investment: Evidence of Geopolitical Effects on Dow Jones Islamic Market Indexes," *Emerging Markets Finance and Trade* 47, no. 6 (2011): 24–45.

[22] Abdelbari El Khamlichi et al., "Are Islamic Equity Indices More Efficient than Their Conventional Counterparts? Evidence from Major Global Index Families," *Journal of Applied Business Research (JABR)* 30, no. 4 (2014): 1137–50.

[23] Robert F Engle and Clive W J Granger, "Co-Integration and Error Correction: Representation, Estimation, and Testing," *Econometrica: Journal of the Econometric Society*, 1987, 251–76.

[24] Fredj Jawadi, Nabila Jawadi, and Abdoulkarim Idi Cheffou, "Are Islamic Stock Markets Efficient? A Time-Series Analysis," *Applied Economics* 47, no. 16 (2015): 1686–97.

[25] Nafis Alam, Shaista Arshad, and Syed Aun R Rizvi, "Do Islamic Stock Indices Perform Better than Conventional Counterparts? An Empirical Investigation of Sectoral Efficiency," *Review of Financial Economics* 31 (2016): 108–14.

In the Asian region, there have been conducted various studies to measure the weak-form efficiency with a specific emphasis on conventional markets. However, there is not sufficiently carried out similar sort of work for Islamic markets. Ardiansyah and Qoyum[26] examined the informational efficiency (semi strong-form) of the Indonesian Islamic index i.e., Jakarta Islamic Index (JII) and as per the statistical results, this study argued that JII is not efficient. Further, Andrianto and Mirza[27] investigated the weak-form of informational efficiency of Indonesian Equity Indices by applying the Run test and Serial Correlation test on daily index price data for the period ranging from 2012 to 2014. They selected three indices Jakarta Islamic Index (JII), LQ45 index, and Kompas 100 index and as per the statistical results of their study, found that Indonesian Stock Exchange showed weak-form efficiency for the time span of 2012-2014. Further, they also contributed that daily price movement of Indonesia stock market is random and there is no correlation between present-day price and previous day price. Ali et al. (2018) compared the Islamic and conventional indices of twelve countries by applying the Multifractal De-trended Fluctuation Analysis (MDFA) in the context of BRICS Stock Market and found that developed market is more efficient, and that except for Pakistan, Jordon, and Russia, all *Sharī'ah* Indices are more efficient than their conventional counterparts.

Methodology and Data:

For this quantitative study of research, a panel secondary data of the daily closing index prices (after adjustments) of eight Islamic indices of Asia (Table 1) were collected for the period w.e.f. 1st July 2009 to 30th June 2018 from the data source of "Datastream".

Table 1: Sample Design

Countries	Islamic Indices
South Asia	
Pakistan	KMI 30 Index
Southeast Asia	
Indonesia	Jakarta Islamic Index (JII)
Thailand	FTSE SET *Sharī'ah* Index
Malaysia	FTSE Malaysia EMAS *Sharī'ah* Index
Singapore	MSCI Singapore Islamic Index
East Asia	
China	FTSE *Sharī'ah* China Index
Japan	FTSE *Sharī'ah* Japan 100 Index
Western Asia	
Turkey	Dow Jones Islamic Market Turkey Index

For sample selection, this study divided the continent Asia into regions of South Asia, Southeast Asia, East Asia and Western Asia by adopting purposive sampling technique. Further, this study selected top economic countries from above-mentioned regions on the basis of higher GDP than other economies in their respective region for the sample which also have Islamic indices and which are also contributing highest share in the GDP of overall Asia because GDP is a very good measure of performance of an economy. So, the sample for this study, selected by purposive sampling, was eight Asian Islamic indices (see Table 1). These economies have Islamic indices and have higher GDP than other economies in their respective

[26] Misnen Ardiansyah and Abdul Qoyum, "Testing the Semi-Strong Form Efficiency of Islamic Capital Market With Response to Information Content of DividendAnnouncement: A Study in Jakarta Islamic Index," *Journal of Modern Accounting and Auditing* 8, no. 7 (2012): 1025–41.

[27] Yanuar Andrianto and Adrian Rishad Mirza, "A Testing of Efficient Markets Hypothesis in Indonesia Stock Market," *Procedia-Social and Behavioral Sciences* 219 (2016): 99–103.

regions and these economies also have more than 70% share in the overall GDP of total continent Asia (World Bank, 2017).

To analyze the informational efficiency (weak-form), daily-returns are computed as:

$$[R_{i,t} = \log\left(P_{i,t}\right) - \log(P_{i,t-1})]$$

In above equation, $R_{i,t}$ denotes the return for index i for the time t, $\left(P_{i,t}\right)$ is the closing index price of index i at time t, and $(P_{i,t-1})$ refers to the closing index price on index i at time t-1.

Methodology:

To examine the weak-form efficiency of Asian *Sharī'ah* indices, **this study tested the Martingale Difference Hypothesis (MDH) and the Random Walk Hypothesis (RWH)**. The weak-form efficiency exists when prices of stocks quickly and accurately incorporate all the historical information. It means, no one can earn the abnormal returns by means of technical analysis and trend in prices.

To test the MDH **'Automatic Portmanteau Test'** is used which is developed by the Escanciano and Lobato[28]. This study also applied the **'Automatic Variance Ratio test'**, which is developed by Choi[29] and Kim[30], to test the RWH. In previous studies, many researchers used conventional tests to determine the serial correlation and randomness of data like the "Box-Pierce Q- statistic test (1970), Unit Root Tests (ADF and PP), Ljung-Box Q-statistic test (1978), Durbin Watson test (DW), LM Test, Run test, Normality test, Variance Ratio, etc." but these tests have certain limitations. For instance, these tests are only applicable under specific assumption like DW test is only applicable when there is no lagged dependent variable in the model and serial correlation assumed to be first order[31]. Moreover, main limitation and disadvantage of previous conventional tests is that these all tests cannot select the number of lag values automatically and the researcher needs to give the number of autocorrelations tested (arbitrary)[32]. Further, these tests are not vigorous in the existence of conditional heteroskedasticity (existence of nonlinear dependence) and do not present higher power in simulations[33]. But that is why, this study used the more advanced and robust statistical techniques which lack the above-mentioned limitations.

Automatic Portmanteau Test (AQ):

Automatic Portmanteau Test (AQ) is used to test the MDH by examining the serial correlation, which was developed by Escanciano and Lobato[34]. A Martingale Difference Sequence (MDS) implies that it is entirely non-predictable from its own history because it has no reliance on mean and no conditional on its own past. According to the MDH, there is no trend and no serial correlation in stock prices and nobody be able to earn the abnormal-returns by beating the market through using the past data (technical analysis) or other strategies because returns are not correlated with past values of returns.

---

[28] J Carlos Escanciano and Ignacio N Lobato, "An Automatic Portmanteau Test for Serial Correlation," *Journal of Econometrics* 151, no. 2 (2009): 140–49.

[29] In Choi, "Testing the Random Walk Hypothesis for Real Exchange Rates," *Journal of Applied Econometrics* 14, no. 3 (1999): 293–308.

[30] Jae H Kim, "Automatic Variance Ratio Test under Conditional Heteroskedasticity," *Finance Research Letters* 6, no. 3 (2009): 179–85.

[31] H D Vinod, ""Generalization of the Durbin-Watson Statistic for Higher Order Autoregressive Processes," *Communications in Statistics-Theory and Methods* 2, no. 2 (1973): 115–44.

[32] Escanciano and Lobato, "An Automatic Portmanteau Test for Serial Correlation."

[33] Escanciano and Lobato.

[34] Escanciano and Lobato.

AQ test is more advanced compared to the models applied in preceding studies (e.g., Run test, Unit Root test (ADF test and PP test), Box-Pierce Q- statistic test, Durbin Watson test (DW), LM Test, etc.) because it is very vigorous and robust in simulations than other models. The key advantage of AQ test is that there is no requirement to specify and give the number of lag orders as the test automatically selects the number of autocorrelations. Further, under the null-hypothesis the optimal value of lag order is one and that is why its asymptotic null-distribution follows the chi-square distribution with one degree of freedom, so there is not require to use a bootstrap process to calculate or estimate the critical values but in alternative hypothesis AQ test select automatically the optimal lag order depending upon the serial correlation existing in data and most importantly, this test is more vigorous to the existence of conditional heteroskedasticity (non-linear dependence). Here AQ is as:

$$AQ = Q_P^*$$

And Q_P^* is:

$$Q_P^* = n \sum_{j=1}^{p} \acute{\rho}_j^2,$$

In supra model Q_P^* is the robustified portmanteau statistic (Escanciano and Lobato 2009), n denotes sample size and Here P denotes to number of autocorrelations or lag order and where ṕ refers to the sample autocorrelation of $Y_t$of order j... and further:

$$\acute{\rho}_j^2 = \frac{\gamma_j^2}{\tau_j}$$

If "Y_t be a stationary process, and $\bar{Y}$ be the empirical average of the sample $\{Y_t\}_{t=1}^{n}$. For j =0…, $n-1$, set as a consistently estimated estimator of the auto-covariance of order j."

$$\gamma_j = \frac{1}{n-j} \sum_{t=j+1}^{n} (Y_t - \bar{y})(Y_{t-j} - \bar{y})$$

Here "Y_t are the returns of the sample at time t and $\bar{Y}$ are the average of returns and $\gamma_j$is the estimator for the autocovariance of Y_t.

$$\gamma_j = Cov(Y_t, Y_{t-j})$$

Further, τ_j, which is the autocovariance of Y_t^2, can be calculated as:

$$\tau_j = \frac{1}{n-j} \sum_{t=j+1}^{n} (Y_t - \bar{y})^2 (Y_{t-j} - \bar{y})^2$$

In above equation, τ_j is the sample analogue of the j^{th} order autocorrelation of $(Y_t - \mu)^2$.
As per the Escanciano and Lobato (2009), under the null hypothesis,
$H_0 = \rho_j = 0$ for $j \geq 1$
Moreover, the AQ is consistent against the alternative H_1^k for $k \leq d$, with"
$H_1^k \neq \rho_1 \neq 0, \rho_2, \ldots, \rho_k \neq 0$

In previous tests, the selection of optimal lag order was arbitrary resulting from using the "Akaike Information Criterion (see Akaike, 1974)" or "Bayesian Information Criterion (see Schwarz, 1978)" but these criteria have some advantages as well as disadvantages. For instance, tests, based on the Bayesian Information Criterion, are more robust and vigorous when the lag order is one for serial-correlation and can appropriately control the type I error

whereas tests, based on the Akaike Information Criterion, can only control the type II error, but they are more effective while the lag order is more than one. So, in this connection, AQ test automatically selects optimal lag order value by using the advantages of both AIC and BIC satisfying the condition explained hereinafter:

$$AQ = Q_{\acute{P}}^{*}$$

Where

$$\acute{P} = \min\{P: 1 \leq P \leq d; L_P \geq L_h, h = 1,2,\ldots\ldots, d\}$$

Where

$$L_P = Q_P^{*} - \pi(P,n,q)$$

Here d refers to the fixed upper bound of natural number i.e. 75, q is a fixed positive number i.e. 2.4 (to get the advantages of both AIC and BIC) and $\pi(P,n,q)$ is a penalty term (which is used to get the combine advantages of both AIC and BIC) that may take the value as:

$$\pi(P,n,q) = \begin{cases} Plogn, & \text{if } \max\sqrt{n}\,|\acute{\rho}_j^{v}| \leq \sqrt{qlogn}, \\ 2P, & \text{if } \max\sqrt{n}\,|\acute{\rho}_j^{v}| > \sqrt{qlogn}, \end{cases}$$

Automatic Variance Ratio Test (AVR):

AVR Test is used to test the Random Walk Hypothesis, which is established by Choi (1999) and Kim (2009), for the purpose of examination of the market efficiency. Previous studies used variance ratio test to evaluate the market efficiency by testing RWH but this test has some limitations like it cannot select the number of holding period / lag value automatically. So, that is why, this study used the more advanced test i.e., Automatic Variance Ratio Test (AVR) which automatically selects the number of holding period / lag values or number of autocorrelations. Most importantly, this test is also vigorous to the existence of conditional heteroskedasticity (non-linear dependence).

One of the momentous assumptions of AVR test is that its asymptotic null distribution follows the standard normal distribution. So, values of AVR Statistic are compared with the table of Standard Normal Distribution and there is not essential to calculate the critical values due to large sample but when the sample size is small then a bootstrapped procedure is used to estimate the critical values which can differ from true ones.

It is defined as:

$$AVR(\acute{k}) = \sqrt{T/\acute{k}}\,[V\hat{R}(\acute{k}) - 1]/\sqrt{2}$$

If Y_t be an asset return at time t (t = 1, . . ., T), then VR computed as:

$$V\hat{R}(\acute{k}) = 1 + 2\sum_{i=1}^{T-1} m(i/\acute{k})\acute{\rho}_i$$

Here $\acute{k}$ denotes the lag order/no of autocorrelation/holding-period by selecting optimally, p refers to the sample autocorrelation of order j, T represents the sample size and $m(i/\acute{k})$ denotes the weighting function with positive and declining weights. In Variance Raito Test (VR test), selection of the lag order/number of autocorrelation/holding-period is arbitrary, which sometimes leads to conflicting results when different values are used. That is why, this present study uses AVR test, which automatically selects the lag order or holding period by selecting optimally. Where $\acute{\rho}_i = \frac{\sum_{t=1}^{T-i}(Y_t - \hat{u})(Y_{t+i} - \hat{u})}{\sum_{t=1}^{T}(Y_t - \hat{u})^2}$ and $\hat{u} = T^{-1}\sum_{t-1}^{T} Y_t$,

Choi (1999) used the quadratic spectral kernel for the 'weighting function i.e., $m(x)$' which is as: $m(x) = \frac{25}{12\pi^2 x^2}\left(\frac{\sin(6\pi x/5)}{6\pi x/5} - \cos(6\pi x/5)\right)$

Results and Discussion:

The descriptive statistics of eight Islamic equity indices for the entire time span (1st July 2009 to 30th June 2018) are reported in Table 235. In descriptive statistics, the daily mean return is measured to examine the average return of the respective index, the standard deviation (SD) of returns to show the dispersion of index's return and to check the normality of data, skewness, kurtosis and Jarque-Bera test are used.

As it can be seen in Table 2 that Pakistan's Islamic index (KMI 30 index) has the maximum daily mean return in all indices but Japan's index (FTSE *Sharī'ah* Japan 100 Index) has the minimum daily mean return in all *Sharī'ah*-compliant indices. Further, by looking at the SD values, it can be said that Chinese indices' returns of Islamic index (FTSE China *Sharī'ah* Index) have the maximum SD and risk in all Islamic indices while on the other hand, returns of Malaysian Islamic index (FTSE Malaysia EMAS *Sharī'ah* Index) have the minimum standard deviation and risk in all indices.

In addition, it is worthwhile to mention here that all the indices' returns are not normally distributed as returns have negative skewness, high kurtosis and Jarque-Bera (JB) statistics authenticate the non-normality as the probability value of JB statistics at 5% significance level is less than .05 and that is why the null hypothesis of normality of returns is rejected. In this respect, it can also be described by viewing the foregoing results that Islamic indices and stocks are the good alternative for investment as some of Islamic indices have good mean daily return and low standard deviation.

Table 2: Descriptive statistics of daily returns for Islamic indices (2009-2018)

Index	**Pakistan**	**China**	**Japan**	**Singapore**	**Thailand**	**Malaysia**	**Indonesia**	**Turkey**
slamic Indices								
Mean	0.00036	0.00008	0.000142	0.00003	0.00014	0.0001	0.00014	0.00019
Sdt. Dev (SD)	0.00503	0.00790	0.005467	0.00377	0.0054	0.0025	0.0057	0.005
Skewness	-0.589	-0.3606	-0.3536	-0.31439	-0.8166	-0.4831	-0.3061	-0.6136
Kurtosis	24.897	182.90	7.9188	5.723	8.07365	6.64351	7.0593	6.9076

Statistical software environment 'R' is used for the descriptive analysis as well as for the AQ Test & AVR Test.

-Further 'VR Test Package' is used to run the AQ Test & AVR Test in R.

Jarque-Bera	44241.6	3158290	2279.1	762.9	2623.1	1309	1535.7	1638.4
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Results for MDH

The AQ Test:

The results of the AQ Test of eight Asian *Sharī'ah*-compliant indices over the entire period (1st July 2009 to 30th June 2018) are reported in Table No. 3. The AQ Test is employed to measure the informational efficiency (weak-form) by testing the MDH.

Table 3: MDH results over the entire period (2009-2018)

Index	akistan	China	Japan	Singapore	Thailan	Malaysia	Indonesia	ſurkey
Islamic Indices								
AQ	0.0460	0.7105	0.0263	0.3537	2.120	14.93**	18.170**	0.0522
P-Value	0.170	0.399	0.129	0.448	0.145	0.00011	0.000	0.181

*Note: *Significance at 10%. **Significance at 5%*

Keeping in view the results of the AQ statistical Test in above Table No.3, it can be clearly seen that Islamic indices of six Asian countries (Pakistan, China, Japan, Thailand, Singapore, and Turkey) did not reject the MDH and were efficient in weak form during the sample period ranging from 1st July 2009 to 30th June 2018 since P-value is more than the cut-off point of .025 and .05 (two tail) at 5% and 10% significance level respectively. Furthermore, Indonesian Islamic index (Jakarta Islamic Index) and Malaysian Islamic index (FTSE Malaysia EMAS *Sharī'ah* Index) rejected the MDH and were not efficient in weak-form. Hence AQ test showed that six Islamic indices failed to reject the MDH.

Results for RWH

The AVR Test:

The AVR Test is employed to examine the informational efficiency (weak-form) by testing the RWH. It is very momentous to mention here that the AVR Test converges to the standard normal distribution as earlier discussed in methodology section in detail. So, values of AVR Statistic are compared with the table of Standard Normal Distribution and there is no need to calculate the critical values due to large sample size but when the sample size is small then a bootstrapped procedure is used to estimate the critical values which can differ from true ones. The null hypothesis of RWH states that prices move randomly and there is no serial correlation or trend in the current day price and previous day price.

Table 4: RWH results over the entire period (2009-2018)

Index	akistan	China	Japan	Singapore	Thailand	Malaysia	Indonesia	key
Islamic Indices								
AVR	-0.390	-5.124**	-0.0738	-0.540	-1.630	5.302**	0.0706	0.195
P-Value	0.3484	0.000	0.4706	0.2946	0.052	0.0000	0.4719	0.4229

*Note: *Significance at 10%. **Significance at 5%*

The results of the AVR test of eight Asian Islamic indices over the entire period (1st July 2009 to 30th June 2018) are reported in Table No. 4. at 5% and 10% significance level. So, keeping in view the results of AVR Test, these findings can be made that during the sample period of 1st July 2009 to 30th June 2018, six Islamic indices of sample countries were weak-form of efficient i.e., Pakistan, Japan, Thailand, Singapore, Indonesia, and Turkey while Islamic indices of Malaysia (FTSE Malaysia EMAS *Sharī'ah* Index) and China (FTSE China *Sharī'ah* Index) were not as P-value is less than the cut-off value of .025 and .05 (two tail).

As per the results of the AQ Statistical Test and AVR Test, it can be found that Islamic indices in Asia have tendency and potential towards the weak-form of market efficiency. It means that in Asian Islamic stock markets, securities' prices reflect the historical information quickly and accurately at the same level.

Combined Results Based on MDH and RWH:

In Table 5, combined results of both tests, i.e., AQ and AVR, are reported. Here, the criterion for denial of the null hypothesis of market efficiency is mentioned hereinafter: the index is considered efficient if none of the tests rejects the efficiency hypothesis at 10% significance level for the time period w.e.f. 1st July 2009 to 30th June 2018. It can be clearly seen in Table 5 that as per the combined results of both tests (AQ test for MDH and AVR test for RWH), only three Islamic indices of the sample (i.e., FTSE China *Sharī'ah* Index, FTSE Malaysia EMAS *Sharī'ah* Index, and Jakarta Islamic index) selected from Asia rejected the market efficiency (weak-form) while remaining five *Sharī'ah*-compliant Indices showed weak-form market efficiency over the sample period.

Table 5: Combined results (MDH and RWH) of Selected Asian Indices (2009-2018).

Index	Pakistan	China	Japan	Singapore	Thailand	Malaysia	Indonesia	Turkey
Islamic Indices	F	R	F	F	F	R	R	F

Note: F refers to 'fail to reject' weak form market efficiency and R refer to 'reject' weak form market efficiency.

Keeping in view the combined results (see Table No.5), it can be posited that Asian *Sharī'ah*-compliant indices are moving towards the informational efficiency (weak-form) as Islamic indices showed overall 63 percent efficiency during the sample time span ranging from 1st July 2009 to 30th June 2018.

It is pertinent to mention here that results of this study corroborates the findings and the results of some previous studies e.g., Ali et al.[36]; Kabbani[37]; Rizvi et al.[38]; etc. On the other hand, results of the present study are not aligned with the results of some of the previous studies e.g., Ali et al.[39]; Andrianto and Mirza[40]; Rizvi et al.[41]; etc.

[36] Ali et al., "Stock Market Efficiency: A Comparative Analysis of Islamic and Conventional Stock Markets."

[37] Abdul Latif Kabbani, "Efficiency of Bursa Malaysia: Analyzing Islamic Indices and Their Counterparties," 2016.

[38] Rizvi et al., "An Analysis of Stock Market Efficiency: Developed vs Islamic Stock Markets Using MF-DFA."

[39] Ali et al., "Stock Market Efficiency: A Comparative Analysis of Islamic and Conventional Stock Markets."

[40] Andrianto and Mirza, "A Testing of Efficient Markets Hypothesis in Indonesia Stock Market."

Conclusions and Implications:

By testing the MDH (Martingale Difference Hypothesis) and RWH (Random Walk Hypothesis), this study examined the weak-form of informational efficiency of eight Asian Islamic indices selected from countries: Pakistan, China, Singapore, Japan, Singapore, Malaysia, Thailand, and Turkey to determine whether Asian Islamic indices (*Sharī'ah*-compliant) are informational efficient or not. For this purpose, this study collected the daily price index data for the time span of 1st July 2009 to 30th June 2018 from DataStream and used the more advanced and robust tests like Automatic Portmanteau Test (developed by Escanciano and Lobato[42]) to test the MDH and Automatic Variance Ratio Test developed by Choi[43] and Kim[44] to test the RWH instead of using the conventional tests (e.g. Unit Root test, Run test, DW test, LM test, Box-Pierce Q- statistic test, Ljung-Box Q-statistic test, etc.). Combined results of AQ test (Automatic Portmanteau Test) and AVR test (Automatic Variance Ratio Test) showed that only three Islamic indices of the sample (i.e., FTSE China *Sharī'ah* Index, FTSE Malaysia EMAS *Sharī'ah* Index, and Jakarta Islamic index) selected from Asia rejected the weak-form of market efficiency while remaining five Islamic Indices showed weak-form market efficiency over the time span 2009-2018.

Keeping in view the combined statistical findings based on MDH and RWH, it can be concluded that Asian Islamic indices are moving towards the informational efficiency (weak-form) as Islamic indices showed overall 63 percent efficiency during the period sampled from 1st July 2009 to 30th June 2018. It means that in Asian Islamic stock markets, securities' prices reflect the historical information quickly and accurately. Despite the infancy/developing stage of Islamic indices, they can be considered as an efficient alternative to the conventional stocks for a variety of investment pursuits. Islamic stocks can be added to portfolio along with conventional stock to diversify the idiosyncratic risk considering the co-integration between Islamic and conventional stocks[45]. In addition, effects of monetary shocks on Islamic indices[46] and the effect of competition on efficiency of Islamic banks and conventional banks[47] as well as the impact of terrorism on Islamic financial markets can be investigated[48] in future.

---

[41] Syed Aun R Rizvi et al., "An Analysis of Stock Market Efficiency: Developed vs Islamic Stock Markets Using MF-DFA," *Physica A: Statistical Mechanics and Its Applications* 407 (2014): 86–99.
[42] Escanciano and Lobato, "An Automatic Portmanteau Test for Serial Correlation."
[43] Choi, "Testing the Random Walk Hypothesis for Real Exchange Rates."
[44] Kim, "Automatic Variance Ratio Test under Conditional Heteroskedasticity."
[45] Samia Nasreen and Sofia Anwar, "Financial Stability and Monetary Policy Reaction Function for South Asian Countries: An Econometric Approach," *The Singapore Economic Review*, 2019, 1–30.
[46] Bo Zhang et al., "Monetary Shocks and Stock Market Fluctuations: With an Application to the Chinese Stock Market," *The Singapore Economic Review* 62, no. 04 (2017): 875–904.
[47] Thanh Pham Thien Nguyen and Son Hong Nghiem, "The Effects of Competition on Efficiency: The Vietnamese Banking Industry Experience," *The Singapore Economic Review* 65, no. 06 (2020): 1507–36.
[48] Faheem Aslam et al., "The Impact of Terrorism on Financial Markets: Evidence from Asia," *The Singapore Economic Review* 63, no. 05 (2018): 1183–1204.