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Testing the Islamic stock market efficiency: the case of FTSE SHARIAH INDEXES

اختبار كفاءة سوق الأسهم الإسلامية: دراسة حالة مؤشرات فاينانشال تايمز الإسلامية

Test de l'efficacité du marché boursier islamique : cas du FTSE SHARIAH INDEXES

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ملخص:

تهدف هذه الدراسة إلى اختبار فرضية المستوى الضعيف لكفاءة مؤشرات الأسهم الإسلامية. تتكون البيانات من أسعار السوق اليومية لمؤشرات فاينانشال تايمز الإسلامية معبرا عنها بالدولار الأمريكي وتغطي الفترة من 14 أكتوبر 2013 إلى 20 أوت 2018. تم إجراء الدراسة باستخدام اختبارات إحصائية مختلفة لفحص المستوى الضعيف للكفاءة. جميع الاختبارات رفضت فرضية العدم المتمثلة في تميز مؤشرات الأسهم الإسلامية بخصائص المستوى الضعيف للكفاءة. وهذا يعني أن التغيرات المستقبلية في الأسعار لا تتحرك بشكل مستقل، وبالتالي فإن أسواق الأسهم الإسلامية لا تتبع نموذج السير العشوائي، وبالتالي يمكن التنبؤ بالعوائد المستقبلية باستخدام الأسعار التاريخية، وهذا ما يثبت أنها تثبت أنها غير كفؤة.

الكلمات المفتاحية:فرضية كفاءة السوق؛السير العشوائي؛ مؤشرات الأسهم الإسلامية؛ عوائد الأسهم.

Abstract:

This study aims to test the hypothesis of the weak level of the efficiency of Islamic stock indices. The data consists of the daily market prices for the Financial Times Islamic indicators expressed in US dollars and covers the period from October 14, 2013 to August 20, 2018. The study was conducted using various statistical tests to check the weak level of efficiency. All tests rejected the null hypothesis that Islamic stock indices are characterized by the characteristics of the weak level of efficiency. This means that future changes in prices do not move independently, and therefore the Islamic stock markets do not follow the random walk model, and therefore future returns can be predicted using historical prices, and this proves that they prove to be inefficient.

Keywords: The efficient market hypothesis; Random walk; Islamic stock indices; stock returns.

Résumé :

Cette étude vise à tester l'hypothèse de l'efficience des indices boursiers islamiques. Nous allons tester empiriquement sa forme faible en analysant la série des rendements de l'indice boursier islamique *FTSE Shariah* par des approches paramétriques et non-paramétriques. Nous avons calculé les rendements quotidiens basés sur les cours de clôture de chaque jour sur la période allant d'octobre 2013 à août 2018. Nous avons utilisé plusieurs tests statistiques tels que le test de racine unitaire, le test d'auto-corrélation, le "runs test" et le test du ratio de variance basé sur les rangs et les signes. Tous ces tests ont rejeté l'hypothèse nulle des indices des marchés boursiers Islamiques caractérisés par le niveau faible d'efficacité durant la période de 2013 à 2018. Cela signifie que le changement des prix ne se fait pas indépendamment et les marchés de bourses islamiques ne suivent pas le modèle aléatoire. On peut donc utiliser l'historique des variations des prix pour prévoir les rendements futurs.

Mots clés : l'hypothèse d'efficience du marché ; marche aléatoire ; Les Indices Boursiers Islamiques ; le rendement des actions.

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Introduction

The efficient market hypothesis (EMH) has been a major research area in the literature for understanding and promoting the quality of financial markets. The concept of EMH connected to the informational efficiency in the financial markets. It refers to the incorporation of available information in setting up of current security prices. Under an efficient market condition, the traders would not be able to make abnormal profits based on historical prices as well as information accessed publicly or privately since all information is already incorporated in the price of the financial assets.

The EMH is linked with the notion of random walk (RW), which in finance literature portray random changes in prices of stocks such that the current prices cannot be predicted from previous prices. The rationale of RW is that the successive price changes are independent, identically distributed random variables, which imply that the series of prices changes has no memory and past cannot be used to predict the future in any meaningful trend.

As the global financial markets becomes globalized, more deregulated, more liberalized, and the financial system was significantly impacted by the global financial crisis, investors found more opportunities for them to create cross-border portfolio and diversify their investments in both conventional and Islamic instruments.

It is interesting to note that there has been tremendous interest in *Shariah*-compliant investments indices and markets, mainly due to their more equitable and profit-sharing nature, which draws considerable research interest in recent years. The fastest growing segment of the global financial industry is reportedly Islamic investments, whichis alleged to yield good returns and is based on desirable ethical precepts desired by some investors in Islamic countries.

Over the past decade, the global capital market scene has witnessed the introduction of Islamic indices, which are designed to filter out the stocks in conventional indices in accordance with the doctrinal position of Islamic laws that introduces a number of ethical considerations for an instrument to be considered as ethically acceptable. Some of the indices are Financial Times *Shariah* Indexes Series (FTSE).

The emergence of the Islamic capital markets provides cross-border capital flow and funding for investment managers and/or companies who are seeking *Shariah*-compliant investments. *Shariah*-compliant investments refer to financial assets that conform to *Shariah* principles. In short, *Shariah*-compliant companies should not be involved in liquor, pork, gambling and interest-based activities to name a few. Although majority of the Islamic financial assets are concentrated in the Middle Eastern and Asian region, however of late, there have been indication of these assets concentration moving to countries in Europe, US and Latin America.

The debate on whether the market is efficient led to two schools. The first school advocates the arguments that markets are indeed efficient. The other school believes that markets are inefficient and therefore investors can make abnormal profits. Nevertheless,a few studies in empirical finance have attempted to test the efficiency of Islamic stock markets in comparison to the many studies in conventional developed stock markets.

Owing to the immense importance of market efficiency as a critical tool for a well-functioning market, which contributes towards effective resource allocation and overall investment

and growth in the economy, the central aim of this study is to test the weak-form efficient market hypothesis specific to Islamic stock markets indices and we test the following hypothesis:

H_0: Islamic stock market indices returns follow a random walk and hence the market is efficient.

The rest of this study is structured as follows: Section 2 provides a brief background of the Islamic stock market. Section 3 discusses the related previous studies on Islamic stock market efficiency. Section 4 discusses the data and methodology. Sections 5 and 6 describe the empirical results and the conclusion of this study.

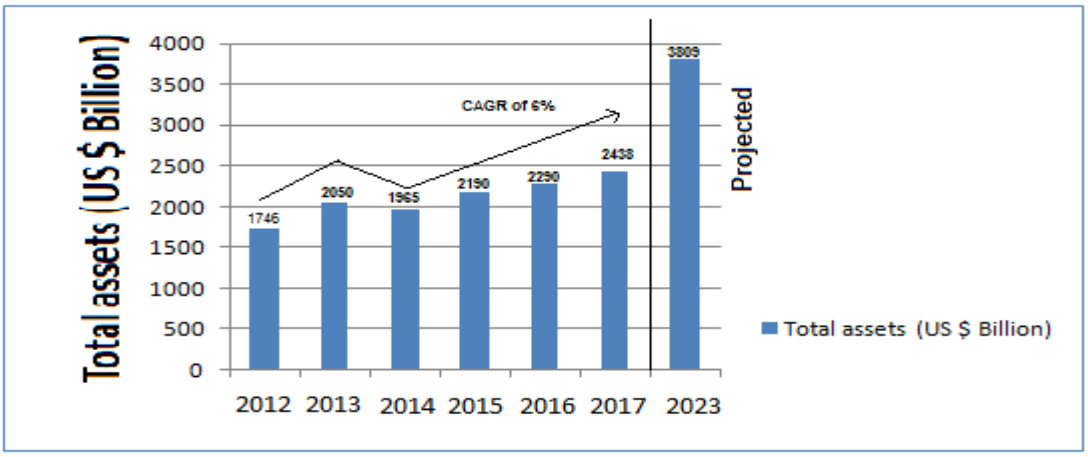
1. Theoretical Background on Islamic stock markets

1.1 Islamic finance significance

Islamic finance refers to a set of legal institutions, financial instruments, practices, transactions and contracts that operate in accordance with the dictates of Islamic Low(Miglietta & Battisti, 2015, p. 334) and with recommendation from the *Shariah* Board. Islamic investments also have to pass financial and operational screening(Merdad, Kabir, & Alhenawi, 2010, p. 164). Islamic financial system requires transactions to be linked to the real sector, leading to fruitful activities that produce income and wealth and rejects that a gain can be realized without taking a risk. The funding to the business entity is permitted, but the return must be tied exclusively to the results linked to the use of capital. This is the base of the Profit and Loss Sharing (PLS) that is a form of partnership, where partners share profits and losses based on their capital share and work(Miglietta & Battisti, 2015, p. 334).

Islamic finance is one of the most rapidly growing segments of the global finance industry (Gait & Worthington, 2007, p. 1). It is now widely developed in several Muslim and non-Muslim countries. Islamic finance industry assets grew by a compound annual growth rate (CAGR) of 6% to US$ 2.44 trillion in 2017 from 2012. The 2017 total was contributed by 56 countries. Iran, Saudi Arabia and Malaysia remain the largest markets, contributing a static share of 65% of the total, or US$ 1.6 trillion. Saudi Arabia and Malaysia's total Islamic finance assets grew 8% and 16%, respectively. For Saudi Arabia, the growth was mainly driven by its domestic and international sukuk issuance. Iran Islamic financial institutions' assets grow 13% in 2017. Of all the 56 countries, Cyprus, Nigeria and Australia saw the fastest growth in Islamic finance assets in 2017(Islamic finance development report, 2018, pp. 14-15).

Figure 1: Islamic Finance Assets Growth 2012-2017



Source:(Islamic finance development report, 2018, p. 15)

The Islamic finance industry's performance is measured through five sub-sectors: Islamic banking, takaful, other Islamic financial institutions (investment companies, micro-finance institutions etc.), sukuk, and Islamic funds.

Table 1. Global Islamic Finance Assets Distribution 2017

	Share of Islamic Finance assets	Size Billion	Number of Institutions/ Instruments	Number of Countries Involved
Sector / Asset Class	71%	1721	505 Islamic Banks	69
Islamic Banking	2%	46	324 Takaful Operators	47
Other Islamic Financial Institutions	6%	135	560 OIFIs	49
Sukuk	17%	426	2590 Sukuk Outstanding	25
Islamic Funds	4%	110	1410 Funds Outstanding	28

Source:(Islamic finance development report, 2018, p. 15)

Islamic finance consequently generates a safe investment climate, guaranteeing moderate risk and promoting equity and social justice, which, in theory, implies an effective financial industry. As demonstrated by the global proliferation of Islamic financial institutions, Islamic financial markets have gained impulse over the past few years; this proliferation has been accompanied by parallel increases in Islamic financial products. Indeed, in the aftermath of the recent global financial crisis (2008–2009), several factors (equity market downturns, bank losses and bankruptcies, Great Depression, etc.) and different studies pointed to the fragility and the high risk associated with conventional finance and banking systems, Islamic finance appears to be a good alternative for investors (Jawadi, Jawadi, & Cheffou, 2015, p. 1687). Islamic stock markets are free from two major sources of instability, namely interest rates and un-backed money creation. High degrees of instability make a stock market inefficient, requiring large resource for trading and hedging risk, and dissuade savers from participation in the markets. Stock market crashes following stock market booms have often ruined household savings and caused economic disorders. A high degree of stability will encourage savers and enable stock markets to achieve maximum efficiency in financial intermediation, reduce trading costs and increase levels of participation (Askari & Krichene, 2014, p. 44).

1.2 What is an Islamic Stock Market?

Islamic stock markets are an integral part of Islamic financial system for efficient mobilization of resources and their optimal allocation. These markets complement the investment role of the Islamic banking sector (Ali, 2008, p. 1). Islamic capital market refers to the capital market where all the transactions, operations and activities are carried as per Islamic laws. The issue of development of Islamic capital market is not separate from the issue of development of capital market in general. The stock market plays a prominent role in the economic development of a country. It not only encourages savings and investments but also enhances corporate governance and social responsibility(Rizvi & Arshad, 2016, pp. 1-2).

The Stock Exchanges in an Islamic economy would perform the following functions (Metwally, 1984, pp. 21-22):

- enable savers to participate fully in the ownership of business enterprise; sharing its profits and risks;

- enable shareholders to obtain liquidity by selling their shares according to the rules of the Stock Exchange;
- allow business enterprises to raise external capital for establishing and expanding their lines of production;
- divorce business operations of the enterprise from short term fluctuations in share prices which are major characteristics of non-Islamic stock markets;
- Allow investment in the economy to be guided by the performance of business enterprise as reflected in share prices.

1.3 Characteristics of a stock exchange in Islam

To describe equity transactions from the Islamic point of view we need to review the four rules that make a transaction acceptable (Kia, 2015, pp. 184-185).These rules are as follows:

- Rule 1: One must not obtain any property in vanities or unacceptable ways or illegally.
- Rule 2: The trade must be based on goodwill and intention among participants.
- Rule 3: Usury is prohibited. According to this rule, usury, contrary to trade, results in the reduction of the stock price among other things.
- Rule 4: One cannot sell a commodity less than what the seller claims or the label indicates.

From the rules 1 and 2, we understand that any transaction based on cheating, aggression, illegal, corruption, subject to asymmetric information, any activity linked among others to prostitution, gambling, production of alcoholic beverages, weapons of mass destruction, is not acceptable from the Islamic point of view and the violation of these rules results in economic or individual destruction. The violation of Rule 4 results in what is known as *gharar* and creates uncertainty. The transactions are accepted, if the qualities and flaws of the commodity (including stocks) transacted were known to the buyer(s) and seller(s). Furthermore, the true price of the commodity should be declared by transacting participants.

From these rules, we understand that the stock of a company that produces any product and is not accepted in Islam (explained above) cannot be traded. Stocks on conventional banks that pay/charge a predetermined interest rate are not Islamic. Furthermore, there should not be any asymmetric information in the market, i.e., equity issuing firms should clearly and accurately publish their balance sheet. Market participants must clearly know the market conditions and situations so that stocks are traded according to their true values.

1.4 Islamic stock indices

The Islamic stock market has captured the interest of not only Muslims but non-Muslim investors as well, who are interested in placing more assets in socially responsible portfolios(Arshad & Rizvi, 2013, p. 1). This trend lead many western financial institutions (e.g. Citibank, Barclays, Morgan Stanley, Merrill Lynch and HSBC) to sell Islamic financial products(Girard & Hassan, 2010, p. 2).Moreover, to the establishment of Islamic indices(e.g. Financial Times Islamic Index Series FTSE; Dow Jones Islamic Market Index DJIM; Standard & Poor *Shariah* Index S&P and Morgan Stanley Capital International Islamic Index MSCI), which are designed to filter out the stocks of corporations in conventional indices, whose business and activities are compatible with Islamic law(Catherine, Nurul, Noor, & Zaminor, 2014, p. 111). These developments provide a

platform to the integration of Islamic finance with conventional finance(Girard & Hassan, 2010, p. 2).

The *Shariah* scholars who supervise the Islamic index defined a set of qualitative (sector) screens and quantitative (financial) screens to identify *Shariah*-compliant equity investments (Derigs & Marzban, 2008, p. 287).

Qualitative screening: Qualitative screens are sector screens through which companies operating within specific business areas that are non-permissible under *Shariah*are excluded. *Shariah* clearly defines a number of aspects, which are not permissible for Muslims, such as the consumption of alcohol and pork, and thus compliant companies are not allowed to participate in business earning primarily or even partially from such activities.

Quantitative screening: The major quantitative screening criteria examine the financial structure of the business and benchmark it against some collectively agreed level of tolerance. Financial structures of companies are measured to gauge the involvement of these companies in non-permissible practices. The relevance of this type of screening in the prohibition of riba and trading of money according to the *Shariah*(Catherine, Nurul, Noor, & Zaminor, 2011, p. 96).

1.5 The Efficient Market Hypothesis

According to Fama (1965), in an efficient market, competition among the many intelligent participants leads to a situation where, at any point in time, actual prices of individual securities already reflect the effects of information based both on events that have already occurred and on events, which as of now the market expects to take place in the future. In other words, in an efficient market at any point in time the actual price of a security will be a good estimate of its intrinsic value (Fama, 1965, p. 56). Jensen (1978) argues that a market is efficient with respect to information set θt, if it is impossible to make economic profits (the risk-adjusted returns net of all costs) by trading based on information set θt (Jensen, 1978, p. 96).

The EMH is linked with the notion of random walk (RW), which in finance literature portray random changes in prices of stocks such that the current prices cannot be predicted from previous prices. The rationale of random walk is that the successive price changes are independent, identically distributed random variables, which imply that the series of prices changes has no memory and past cannot be used to predict the future in any meaningful trend (Shamshir & Mustafa, 2014, p. 2).

Several versions of the Efficient Market Hypothesis have been widely discussed and tested in the literature. The differences revolve primarily around the definition of the information set θt used in those tests. The three broad categories of hypotheses that have developed are (Jensen, 1978, p. 96): The Weak Form of the EMH, in which the information set θt is taken to be solely the information contained in the past price history of the market as of time t. The Semi-Strong Form of the EMH, in which θt is taken to be all information that is publicly available at time t. (This includes, of course, the history of prices so the weak form is just a restricted version of this.) The Strong Form of the EMH, in which θt is taken to be all information known to anyone at time t.

The equality between price and value of a given stock would be achieved only when there is informational efficiency. Informational efficiency implies that there are no lags in the dissemination and assimilation of information and is a prerequisite to pricing efficiency. Another prerequisite to pricing efficiency is operational efficiency, which implies that transactions should be executed at

minimal costs. High transaction costs prevent price adjustment to take place instantaneously and accurately. It is clear that any move or regulation that reduces transaction costs, simplifies trading system, increases the availability and accuracy of information, improves information processing by participants is a step towards improving the allocation efficiency of the system (Obaidullah, 2001, pp. 2-3).

2. Literature Review

The debate on whether the market is efficient has attracted the interest of many researchers and led to two schools. The first school advocates the arguments that markets are indeed efficient. The other school believes that markets are inefficient and therefore investors can make abnormal profits. With the growing importance of the Islamic stock markets that run parallel to the conventional stock markets, question arises as to whether these Islamic stock markets are also efficient, but relatively limited studies have focused on the Islamic stock market efficiency. Most of the studies are qualitative in nature, focusing on the framework and *Shariah* principles of the Islamic stock markets.

Ali et al. (2018) conducted a study on 12 Islamic and conventional stock markets counterparts using MF-DFA analysis. The full sample results indicate that developed markets are relatively more efficient, followed by the BRICS' stock markets. The comparative efficiency analysis shows that almost all the Islamic stock markets excluding Russia, Jordan and Pakistan are more efficient than their conventional counterparts. Implying that Islamic stock markets are new, however the peculiar nature, *Shariah*-compliant laws, good governance, and disclosure mechanisms make them more efficient. Further, the results indicate that the Islamic markets adjustment to speculative activity is higher than their conventional (Ali, Shahzad, Raza, & Al-Yahyaeed, 2018).

Noryati (2016) examined the weak form efficiency of the Islamic stock indices from China, India, South Africa, Malaysia, Dubai, Qatar and Japan, using Autocorrelation Function (ACF) test and Variance Ratio (VR) test. Interestingly only the Islamic stock indices for Malaysia and India are weak form efficient while the results of the Islamic stock indices for Qatar and Kuwait are not. The results of the other Islamic stock indices studied are inconclusive(Noryati, 2016).

Jawadi et al. (2015) investigates the weak-form informational efficient hypothesis for three major Islamic stock markets using parametric and nonparametric tests. The analysis offers two interesting results. First, emerging Islamic stock markets seem to be less efficient than developed Islamic markets, suggesting interesting investment opportunities and diversification benefits from this region in both the short run and the long run. Second, non-rejection of the co-integration hypothesis for developed Islamic markets and the global conventional stock market point to efficiency for the former in the long term, even if it is inefficient in the short term (Jawadi, Jawadi, & Cheffou, 2015).

Rizvi et al. (2014) conducted a comparative analysis for 22 broad market indices of Islamic and developed countries markets by extending the understanding of their multi-fractal nature. The findings provide a deeper understanding of the markets in Islamic countries, where they have traces of highly efficient performance particularly in crisis periods. A key finding is the empirical evidence of the impact of the stage of market development on the efficiency of the market(Rizvi, Ginanjar, Obiyathulla, & Mansur, 2014).

Khalichi et al. (2014) analyzed the weak-form efficiency level by testing the random walk hypothesis using variance ratio tests. The results show that Islamic indices have the same level of inefficiency as conventional ones, the indices of MSCI and FTSE families are the less inefficient. In terms of co-integration analysis, Islamic indices of Dow Jones and S&P have no co-integrating relations with their respective benchmarks, which suggests the existence of long-run diversification opportunities(Khalichi, Sarkar, & Teulon, 2014).

Ardiansyah&Qoyum (2011) tested the efficiency of Islamic capital market, which focuses Jakarta Islamic Index as a case study. The first test that shows that dividend announcements are not eligible to serve as a consideration in decisions regarding the stock price at the JII, and the study concludes that the Islamic capital market is not efficient in information(Ardiansyah & Qoyum, 2011).

Guyot (2011) analyzes both the market quality and price dynamics of a sample group of Islamic indexes. The results highlight that efficient investment allocation is not compromised by the application of *Shariah* criteria(Guyot, 2011).

In summary, existing literature relating to Islamic stock market efficiency is limited and provides contradicting findings. This study therefore aims to contribute to the empirical literature by comparatively investigates the efficiency of Islamic stock market indices with the most recent data.

3. Data and Methodology

3.1 Description of the Data

The data consists of daily market prices FTSE *Shariah* Indexes expressed in US$ to avoid change risk (Table 2). Data were obtained from Investing.com Historical Data and cover the period from 14 October 2013 to 20 August 2018 resulting in total observations of 1263 excluding public holidays**.**

Table 2. FTSE *Shariah* Indexes

FTSE *Shariah* Indexes	Symbol
FTSE *Shariah* All World	FTSWORLDS
FTSE *Shariah* Developed	FTSWD
FTSE *Shariah* Emerging	FTSWALLE

Source: own processing

The daily market prices are transformed into continuously compounded returns as given in the following equation:

$$r_{i,t} = 100 \times ln\left(\frac{p_{i,t}}{p_{i,t-1}}\right)$$

Where: $(p_{i,t})$ is the Index Prices for the index (i) at time (t) and $(r_{i,t})$ is the stock market return.

3.2 Methodology

As highlighted in the previous section, a market is efficient if all available information is reflected in the prices of the financial assets. Investors are not able to predict the movement of prices if information arrives randomly. Random walk hypothesis (RWH) stated that change of financial price is independent of past financial price changes and therefore current financial prices are not related to its past prices. RWH is classified as is known as a weak form of EMH. Therefore,

our prime investigative look is to find the evidence on weak form efficiency and we test the following hypothesis:

H_0: Islamic stock market indices returns follow a random walk and hence the market is efficient.

This study is conducted by using following different statistical tests to examine the weak-form market efficiency of each Islamic stock indices studied including Unit Root test, Runs test, Serial correlation (autocorrelation) test and Variance Ratio (VR) test.

3.2.1 Unit Root test

It is a test to verify the presence of stationary properties in the time series data. Unit root test can be used for testing the efficiency of markets, because market efficiency demands randomness (non-stationary) in the prices of security. In this study, three alternative tests are employed namely the Augmented Dicky and Fuller (1979) (ADF), the Phillips and Perron (1988) (PP) and Kwiatkowski et al. (1992) (KPSS) tests was selected for test of unit root.

H_0: The daily stock returns series has a "unit root", series are not stationary and it may follow a "random walk".

If the result of the t-statistic test is higher than Mackinnon's critical value, for significance levels of 1% and 5%, the null hypothesis of unit root presence (data is not stationary and follow a random walk) within the daily stock returns series, cannot be rejected (be accepted) and, consequently, the Islamic stock market to be efficient in weak form.

3.2.2 The Runs Test

The Runs Test is a non-parametric test, which is used to test the randomness of the series which auto correlation fails to do. Runs Test is a traditional method used in the random walk model and ignores the properties of distribution. It has been used to judge the randomness in the behavior of the Islamic Stock markets. It determines whether successive price changes are independent. It ignores the absolute value in a time series and takes into consideration the price changes of the same sign. In this test, actual number of runs is being compared with the expected number of runs. If the actual number of runs is not significantly different from the expected number of runs, then the price changes are considered independent, and if this difference is significant then the price changes are considered dependent.

In order to test the significant difference between the actual number of runs and expected number of runs, the test statistics employed will be 'Z'.

H_0: The observed series are random (The number of expected runs is about the same as the number of actual runs).

The Z-value is tested at 5% significant level. The null hypothesis is rejected if the calculated number of runs falls outside the 95% confidence interval (p-value<5%), the daily stock returns series do not follow a random walk and, consequently, the Islamic stock market to be inefficient in weak form. The null hypothesis is accepted if the value lies in between ±1.96 (p-value>5%).

H0: The observed series are random (The number of expected runs is about the same as the number of actual runs).

3.2.3 Serial correlation (autocorrelation) test

The weak form argues that there should be no correlation between the stocks prices or returns movements over time. This can be tested statistically. We apply the Autocorrelation Function (ACF) test to examine the significance of serial correlation coefficients and disclose the validity of random walk hypothesis.

Autocorrelation sets out the case where the stock price movement for a day t is related to the price movements in a previous day's t-1, t-2…. t-n. If the Islamic stock markets were efficient then there would be an insignificant relation between return on day t with the return on day t-1, t-2… t-n.

The Ljung–Box test is a type of statistical test of whether any of a group of autocorrelations of a time series is different from zero. Instead of testing randomness at each distinct lag, it tests the "overall" randomness based on a number of lags.

H_0: correlation =0, no significant correlation exists between returns changes, there is randomness in return series.

If the stocks returns are serially correlated, we will reject the null hypothesis, which means that Islamic stock market is inefficient at weak form level.

3.2.4 Variance Ratio (VR) test

Lo and MacKinlay (1988) suggest the use of a variance-ratio (VR) statistic to test the random walk hypothesis. The VR procedure is motivated by the fact that the variance of a random walk increases linearly with time. The VR test statistics are used to test the random walk under assumptions of hetroskedastic by using asymptotic distributional.

H_0: VR(q) = 1, the daily stock returns series of the Islamic stock market follows a "random walk" and, the returns are not serially correlated.

If the variance ratio is equal to one then it means that stocks follow random walk and null hypothesis will be accepted. When the random walk hypothesis is rejected and VR(q)>1 (VR(q)<1) returns are positively (negatively) serially correlated.

4. Results and discussion

4.1 Data Properties and the normal distribution test results

Before the application of different statistical tests for market efficiency, we have examined the descriptive statistics. Table 3 contains descriptive statistics and diagnostics of naturally logged computed daily returns for the three FTSE Islamic stock indices investigated. From these summary statistics, several traits can be identified. Firstly, the table shows that daily mean returns for all the series examined are close to zero. With the exception of the FTSWALLE, the rest of the Islamic stock indices reported in table 3 show positive mean returns behavior. Additionally, it can be seen that the Islamic stock markets analyzed series are characterized by higher levels of volatility given that the standard deviations are significantly higher than the mean.

Table 3. Descriptive statistic

	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.	Obs.
FTSWORLDS	0.0084	0.2823	-0.6767	7.4003	1115.356	0.0000	1263
FTSWD	0.0093	0.2852	-0.7004	7.4648	1152.302	0.0000	1263
FTSWALLE	-0.0015	0.3743	-0.3868	5.8190	449.683	0.0000	1263

Source: Calculated by the researcher based on Eviews9

We also noted significant asymmetry and a negative skewed return distribution for all indexes. In addition, high excess kurtosis values suggest that all the stock return distributions are highly Leptokurtic relative to the normal distribution. This result is confirmed by the Jarque–Berra test statistics, which reject the hypothesis of a normal distribution for any of the Islamic stock index returns investigated at the 1% significance level. The rejection of the hypothesis of a normal distribution is an indication of inefficiency. The normality tests only provide a statistical analysis and may not be conclusive as the distribution of stock returns is not normal. For greater accuracy, we tested efficiency using more developed approaches.

4.2 Unit Root test results

Table 4 reports conventional unit root and stationarity test results for time series of the Islamic stock index. Three alternative tests are employed namely the Augmented Dicky and Fuller (1979) (ADF), the Phillips and Perron (1988) (PP) and Kwiatkowski et al. (1992) (KPSS) tests.

Table 4. Unit root and stationarity tests

Index		ADF t-tests		PP t-tests		KPSS t-tests	
		tμ	tτ	tμ	tτ	Hμ	hτ
FTSWORLDS		-29.17	-29.170	-28.700	-28.688	0.0770	0.0570
FTSWD		-29.792	-29.782	-29.405	-29.393	0.0679	0.0540
FTSWALLE		-29.683	-29.689	-29.535	-29.532	0.1793	0.0864
critical values	1%	-3.435	-3.965	-3.435	-3.965	0.739	0.216
	5%	-2.863	-3.413	-2.863	-3.413	0.463	0.146

Notes: tμ and tτ are the standards augmented Dickey-Fuller (ADF) test statistics and Phillips–Perron (PP) test statistics when the relevant auxiliary regression contains (a constant) and (a constant and trend) respectively. ημ and hτ are the KPSS test statistics when the relevant auxiliary regression contains (a constant) and (a constant and trend) respectively.

Source: Calculated by the researcher based on Eviews9

As can be observed, the test value is inferior to the critical values, for both significance level (1% and 5%). Therefore, the test rejects the null hypothesis, which states that, the Islamic stock returns' series has a unit root. This indicates that the series are stationary and does not follow a "random walk" type of stochastic process, thus the market on which the prices had been recorded is informationally inefficient in the weak form.

4.3 The Runs Test

With the help of MS Excel, Runs test is applied on the series of data of the Islamic stock markets Indexes. The result of this test is reported on table 5.

In the all cases, it is noted that the z-value is computed as -2,420, -1,317 and -5,173 respectively. This values falls outside the 95% confidence interval and so we cannot accept the null hypothesis. This implies that the succeeding price changes do not move in an independent manner and so these Islamic Stock Indexes does not follow the random walk model, reveals that the future returns can be predicted by using the historical prices, and proves that they are a weak form inefficient stock market.

Table 5. The Runs Test result

	Mean	Obs.	Actual Runs	Obs. <Mean	Obs. >Mean	Exp. Runs	Sta. Dev.	Z-stat	Prob.
FTSWORLDS	0,0084	1263	589	613	650	631,95	17,747	-2,420	0,0077
FTSWD	0,0093	1263	609	623	640	632,39	17,759	-1,317	0,0939
FTSWALLE	-0,0015	1263	539	597	666	630,62	17,709	-5,173	0,0001

Source: Calculated by the researcher based on MS Excel

In order to get more evidence, runs test must operate on different frequency of time series. Financial theory analysts and academics argue that using only daily returns might cause spurious results because of the serial correlation.

4.4 Serial correlation (autocorrelation) test result.

The table 6 represents Ljung-Box test for higher order autocorrelations for stock return index. Tests for the absence of serial correlation over time between returns were implemented from lag 1 up to lag 10 for the all daily return indices series.

Table 6. Serial correlation (autocorrelation) test result.

Lags		1	2	3	4	5	6	7	8	9	10
FTSWORLDS	AC	0.193	-0.001	0.014	-0.081	-0.046	0.008	-0.011	-0.016	-0.003	-0.041
	Q-Stat	47.270	47.272	47.533	55.877	58.606	58.690	58.835	59.165	59.173	61.305
	P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FTSWD	AC	0.173	-0.007	0.014	-0.076	-0.051	0.012	-0.008	-0.021	-0.003	-0.044
	Q-Stat	37.989	38.050	38.312	45.611	48.921	49.105	49.180	49.748	49.757	52.202
	P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FTSWALLE	AC	0.177	0.020	0.024	-0.061	-0.030	-0.018	0.022	0.030	0.013	0.005
	Q-Stat	39.469	39.985	40.720	45.476	46.583	46.990	47.623	48.765	48.984	49.011
	P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Calculated by the researcher based on Eviews9

Table 6 shows that for the all cases, there is highly significant autocorrelation (P-value<5%) for all lags at the 5% level, implying that the test rejects the null hypothesis, which states that, the Islamic stock returns' series has no significant correlation exists between returns changes. This indicates that the series does not follow a random walk and the market recorded is inefficient in the weak form.

4.5 Variance Ratio (VR) test result.

Table 7. Variance Ratio (VR) test.

		q				Joint Tests	
		2	4	8	16	Value	Prob.
FTSWORLDS	Var. Ratio	0.6213	0.3356	0.1582	0.0798	8.4398	0.0000
	Z-Statistic	-8.4398	-8.0320	-6.8674	-5.4852		
	Probability	0.0000	0.0000	0.0000	0.0000		
FTSWD	Var. Ratio	0.6096	0.3259	0.1552	0.0779	8.6702	0.0000
	Z-Statistic	-8.6702	-8.1144	-6.8793	-5.5129		
	Probability	0.0000	0.0000	0.0000	0.0000		
FTSWALLE	Var. Ratio	0.5960	0.3232	0.1481	0.0755	9.1442	0.0000
	Z-Statistic	-9.1443	-8.4708	-7.2222	-5.5987		
	Probability	0.0000	0.0000	0.0000	0.0000		

Source: Calculated by the researcher based on Eviews9

Table 7 shows the results of the variance-ratios test for the Islamic stock market returns indices. Columns 3 to 6 indicates the specific time period q, which is the number of interval days, where q = 2, 4, 8 & 16 days for each series. Columns 7 & 8 report the test statistics for each index return series examined. As reported in this table, since joint probability value is smaller than 1% and z-statistic doesn't fall between ± 1.96, hence we reject the null hypothesis and concluded that return series of all Islamic stock markets don't follow random walk or VR ≠1 for any intervals of q tested in the study. However, because the reported values of the variance-ratio VR(q) are below 1, there appears to be negative serial correlation in the series.

Conclusion and summary

This study attempts to investigate whether the Islamic stock indices are weak form efficiency. ThreeIslamic stock indices of World, Developed and Emerging are used to achieve the objective of the study. For greater accuracy, we tested the efficiency of FTSE *Shariah* Indexes using many developed approaches. Unit Root test, Runs test, Autocorrelation Function (ACF) test and Variance Ratio (VR) test are used to attain this objective. Table 8 summarizes the results of the tests performed.

Table 8. Summary of test results

	Normal distribution test	Unit Root test	Runs test	Autocorrelation Function test	Variance Ratio test
FTSWORLDS	No	No	No	No	No
FTSWD	No	No	No	No	No
FTSWALLE	No	No	No	Yes	No

Source: own processing

All tests, rejects the null hypothesis of the weak form efficiency for any of the Islamic stock indices returns investigated. This implies that the succeeding price changes do not move in an independent manner and so these Islamic Stock Markets does not follow the random walk model, reveals that the future returns can bepredicted by using the historical prices, and proves that they are inefficient stock market and therefore investors can make abnormal profits.Our findings are the same as Noryati (2016), Jawadi et al. (2015), Khalichi et al. (2014) and Ardiansyah&Qoyum (2011) mentioned.

Several implications are inferred from the empirical evidences obtained from this study. For investors, weak-form inefficient Islamic stock markets do not suggest that short-term profits can be obtained but also huge losses can also be realized. In addition, inefficient Islamic markets also reflect the inability of the markets to offer efficient allocated and fairly priced equity capital that is fundamental to the national and regional development of Islamic financial institution(Noryati, 2016, p. 26).

Due to the limited data, the author could not examine the semi and strong forms of market efficiency in Islamic indices. This study is also limited to only three FTSE Islamic indices over the period 14 October 2013 to 20 August 2018. Moreover, due to the scarcity of previous literatures related to the market efficiency of Islamic indices, this study faced limitation to compare and conclude if the empirical findings obtained are similar or dissimilar to previous studies. Furthermore, this study uses only Unit Root, Run, Autocorrelation, and Variance Ratio tests to answer the research questions and to examine the hypotheses.

In terms of academic research, it would be interesting to study more indices since our study is limited to global Islamic indices. Future works should go for in depth analysis to look into Islamic sub-indices of each Islamic index family (i.e. Standard and Poor's, Morgan Stanley Capital International and Dow Jones). These Islamic equity indices cover more global, regional and country levels. This study must be improved by using some different methodologies of testing the informational efficiency (such as vector autoregressive regression and impulse response function); different methodologies may also lead to different results. Among these, we could mention a wider data set, as well of some variables that reflect the impact of institutional and functional changes that influence the capital market.

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