Journal of Economic Cooperation and Development, **44**, 1 (2023), 1-24

Random Walk Hypothesis and COVID-19: A Study on the Emerging Islamic Stock Index

Bee-Hoong Tay[1]

ABSTRACT

This study investigates the effect of COVID-19 on the random walk behavior of the emerging Islamic stock market over the period from October 9, 2019, to August 11, 2020. Two Islamic stock indices, namely the FTSE Bursa Malaysia Hijrah Shariah Index and the FTSE Bursa Malaysia EMAS Shariah Index, are examined in this study. The unit root test and variance ratio test are employed to examine the random walk hypothesis. The results of the study showed that (i) Islamic stock indices did not follow a random walk process before and during COVID-19, as well as for the entire period, thus suggesting that the emerging Islamic stock market is not weak form efficient, and (ii) returns for Islamic stock indices were much higher and more volatile during the period of COVID-19. The findings of this study have important implications. First, the stationarity of the return series suggests that it is possible to gain excess return, thus offering investors the opportunity to diversify investment risk. Second, the findings of inefficient weak form Islamic stock indices suggest that stock market regulators may undertake policies to develop the stock market and improve information dissemination in order to promote more efficient resource allocation.

ملخص

تبحث هذه الدراسة في تأثير كوفيد-19على سلوكيات السير العشوائي التي اعتمدتها أسواق الأسهم الإسلامية الناشئة خلال الفترة الممتدة بين 9 أكتوبر2019 و11 أغسطس 2020. وتتناول هذه الدراسة مؤشران للأسهم الإسلامية، هما مؤشر الهجرة المتوافق مع الشريعة لفوتسي وبورصة ماليزيا (FTSE Bursa Malaysia Hijrah Shariah Index) ومؤشر EMAS

[1] Faculty of Business and Management, Universiti Teknologi MARA Cawangan Johor Kampus Segamat, Johor, Malaysia.
E-mail: taybe869@uitm.edu.my

المتوافق مع الشريعة لفوتسي وبورصة ماليزيا (FTSE Bursa Malaysia EMAS Shariah Index). استُخدم كل من اختبار جذور الوحدات واختبار نسبة التباين لدراسة فرضية السير العشوائي. حيث أظهرت نتائج الدراسة أن (1) مؤشرات الأسهم الإسلامية لم تتبع عملية سير عشوائية قبل وخلال فترة تفشي كوفيد-19، ولا خلال الفترة بأكملها، مما يشير إلى أن سوق الأسهم الإسلامية الناشئة ليس سوقا ضعيف الكفاءة، كما أن (2) عائدات مؤشرات الأسهم الإسلامية كانت أعلى بكثير وأكثر تقلباً خلال فترة كوفيد-19. وتنطوي نتائج هذه الدراسة على آثار مهمة. أولاً، يشير ثبات سلسلة العائدات إلى أنه من الممكن كسب فائض في العائدات، وبالتالي إتاحة الفرصة للمستثمرين لتنويع مخاطر الاستثمار. ثانياً، تشير نتائج مؤشرات النوع ضعيف الكفاءة من الأسهم الإسلامية إلى أن منظمي السوق المالي قد يتخذون سياسات لتطويره وتحسين نشر المعلومات من أجل تعزيز الكفاءة في تخصيص الموارد.

ABSTRAITE

Cette étude examine l'effet du COVID-19 sur le comportement de marche aléatoire du marché des bourses islamiques émergentes au cours de la période allant du 9 octobre 2019 au 11 août 2020. Deux indices boursiers islamiques, à savoir l'indice FTSE Bursa Malaysia Hijrah Shariah et l'indice FTSE Bursa Malaysia EMAS Shari'ah, sont examinés dans cette étude. Le test de racine unitaire et le test de ratio de variance sont utilisés pour examiner l'hypothèse de marche aléatoire. Les résultats de l'étude montrent que (i) les indices boursiers islamiques n'ont pas suivi un processus de marche aléatoire avant et pendant le COVID-19, ainsi que pour l'ensemble de la période, suggérant ainsi que le marché boursier islamique émergent n'est pas efficient de forme faible, et (ii) les rendements des indices boursiers islamiques ont été beaucoup plus élevés et plus volatils pendant la période du COVID-19. Les résultats de cette étude ont des implications importantes. Premièrement, la stationnarité des séries de rendements suggère qu'il est possible d'obtenir des rendements excédentaires, offrant ainsi aux investisseurs la possibilité de diversifier le risque d'investissement. Deuxièmement, les résultats de l'inefficacité des indices boursiers islamiques de forme faible suggèrent que les régulateurs du marché boursier peuvent entreprendre des politiques pour développer le marché bourses islamiques et améliorer la diffusion de l'information afin de promouvoir une allocation des ressources plus efficace.

Keywords: Random walk hypothesis, COVID-19, Islamic stock index

JEL Classification: G12, G14, G41

1. Introduction

Islamic finance and economic growth are strongly correlated (Hassan et al., 2022). As an alternative to conventional financial products, Islamic financial products offer a good alternative to investors in terms of portfolio diversification and risk mitigation (Jawadi et al., 2014). The Islamic financial sector has experienced steady growth and offers great opportunity to Muslim and non-Muslim investors with its unique shariah-compliance characteristics, such as ratio screening, prohibition on activities, and elements of usury (riba), gambling (maisir), and ambiguity (gharar) (Saiti et al., 2014). In making investment decisions in the stock market, investors depend on the information attached to the stock prices. Thus, the informational efficiency of the stock market is important to help explain how changes in stock prices take place in the financial market (Tay, 2019). The COVID-19 pandemic brings uncertainty to global health and the economy; therefore, the impact of COVID-19 on the stock market has to be comprehensively studied (Lee et al., 2020).

According to Fama (1970), in an efficient market, a security's price fully reflects all available information. Thus, stock prices should move randomly and only in response to unpredictable news. The random walk behavior of stock prices is used to explain the weak form market efficiency. If the stock price follows a random walk process, past prices cannot be used to predict the future price of the stock, and thus the market is weakly efficient. On the other hand, when stock price does not exhibit random walk behavior, this infers that future price can be predicted using historical price information, thus suggesting that stock market is not weak form efficient. With the eruption of the COVID-19 pandemic, questions arise on whether stock prices still follow a random walk, and the stock market remains weak form informational efficient? The news about the coronavirus is found to have an impact on the stock market in the GCC countries such as Saudi Arabia, the United Arab Emirates, and Qatar (Irfan et al., 2022; Al Samman and Akkas, 2021). Hidayah and Swastika (2022) demonstrated the effectiveness of the Islamic stocks during the pandemic, and investors are more likely to exhibit herding behavior in the

European market as they are more sensitive to asset losses compared to Asian markets (Aslam et al., 2021).

Malaysia began the movement control order on March 18, 2020, to deal with the increasing COVID-19 cases in the country. However, it is unclear how the COVID-19 will empirically affect the emerging Malaysian stock market after the restriction on movement orders has taken place. This study is motivated to address this gap in the literature. Despite the recent study on the impact of COVID-19 on the stock market, little emphasis has been placed on the random walk behavior of the stock price in explaining weak form hypotheses, in particular for the Islamic stock index in the emerging market. This study is motivated to address this gap in the literature. As the information efficiency of a market is important for investors and traders, studies on market efficiency become relevant to facilitate changes in regulation and policy to promote information dissemination and price correction in the market (Neifar and Gharbi, 2022).

This study examines the impact of COVID-19 on the random walk behavior of the Islamic stock index in Malaysia. The Islamic stock indices, i.e., the FTSE Bursa Malaysia Hijrah Shariah Index (HJR) and the FTSE Bursa Malaysia EMAS Shariah Index (ES), are adopted in this study. The analysis of the study is conducted by using three unit root tests, i.e., Augmented Dickey-Fuller, Phillips-Peron and Kwiatkowski, Phillips, Schmidt, and Shin tests, as well as three variance ratio tests, i.e., Lo and MacKinlay's (1988) variance ratio, wild bootstrapping, and rank scores, over the period of October 9, 2019, to August 11, 2020. This study has three contributions. First, it contributes to the study on the impact of COVID-19 on the stock market. Second, the study of the efficiency of the Islamic stock market contributes to the existing literature of efficient market hypotheses, which is dominated by studies of the conventional stock market. Third, it adds to the existing body of knowledge on the topic of the weak form market efficiency of Islamic stock indices in emerging countries.

The remainder of this paper is organized as follows: Section 2 addresses the literature review. Section 3 describes the data and methodology. Section 4 delivers the empirical results and discussion. Section 5 provides the concluding remarks.

2. Literature Review

Over the past decades, there have been substantial studies focusing on the random walk behavior in stock market or weak form market efficiency. However, compared to the conventional stock market, the literature on random walk behavior in the Islamic stock market in the emerging market remains scarce. The random walk hypothesis (RWH) is closely related to the weak form efficient market hypothesis that characterizes random departures of security prices from their historical prices (Malkiel, 2003). Since the seminal work of Fama (1970), the study of market efficiency has initially focused on the conventional stock indices of advanced and emerging countries. Based on the wavelet unit root tests, Tiwari and Kyophilavong (2014) provided evidence that supports the predictability of BRICS stock market indices over the period of January 2000 to December 2010.

Khrapko (2013) revealed that the stock market indices of Ukraine, the USA, Poland, and Russia follow the random walk process. Chen and Metghalchi (2012) reported the weak form market efficiency in the Brazilian stock market, evidenced by several trading rules over the period of January 1996 to January 2011. Based on the multiple variance ratio tests, Charles and Darné (2009) demonstrated that over the 1992-2007 periods, Class A shares of the Chinese stock exchange appeared to be more efficient, while Class B shares did not follow the random walk process. However, Karasiński (2020) found that European stock markets faced a significant drop in efficiency between 2006 and 2008 but showed signs of improvement after the end of the 2008 global financial crisis, following the positive effects of regulation implemented after the crisis.

On the contrary, Sánchez et al. (2020) highlighted the inefficiency of Latin American stock markets over the period of 2002 to 2007. The findings of market inefficiency were in line with Rehman et al. (2018), who rejected the null hypothesis of random walk in the daily return data of three emerging markets, namely Pakistan, India, and Bangladesh, by using the runs test and the state space model over the period of 2005 to 2017. The inefficiency of the stock market is supported by Khan et al. (2016), who confirmed that the KSE-100 did not follow a random walk process over the period of 1997 to 2014 based on Wright's rank-score variance ratio test. Fama and French (1988) and Mukherji (2011) found that the stock returns did not follow the random walk process and were not normally distributed in the US stock markets. The findings of weak form inefficiency of stock returns therefore offer investors chances to make an abnormal profit by predicting the historical data (Pervez et al., 2018).

Despite their inconsistent findings, the empirical studies on the random walk hypothesis and weak form market efficiency have produced mixed results. Shaik and Maheswaran (2017) found weak form efficiency in the markets of Cambodia, Laos, and Singapore and pointed out that markets in Indonesia, Malaysia, the Philippines, Thailand, and Vietnam were not informationally efficient. Based on the variance ratio tests, Lahmiri (2013) demonstrated that investors may use historical prices to predict future returns and take profit in the less efficient markets of Kuwait, Tunisia, and Morocco. However, based on the data from January 2010 to September 2012, the study concluded that the stock markets of Jordan and the Kingdom of Saudi Arabia were not predictable.

Borges (2010) reported that the random walk behaviors were not persistent across the European stock markets from January 1993 to December 2007. By employing the augmented Dickey-Fuller test, the runs test, the serial correlation test, and the multiple variance ratio test, they found that France, Germany, the UK, and Spain held most of the conditions for random walk behavior; however, the random walk hypothesis was rejected due to the existence of serial correlation in Greece and Portugal. In the same vein, Chaudhuri and Wu (2003) indicated that ten out of seventeen emerging stock markets did not exhibit random walk behavior in the tests that account for the structural breaks.

Although Islamic finance has received much attention in the past decade, empirical evidence of its informational efficiency in the emerging market is scarce. In general, emerging Islamic stock markets were found to be less efficient in the short run compared to developed Islamic stock markets (Bouoiyour et al., 2018; Jawadi et al., 2015). Sensoy et al. (2015) revealed that conventional markets are found to be more efficient compared to their Islamic counterparts based on the permutation-entropy approach. However, Mensi et al. (2017) argued that the Islamic sectoral indices were time-varyingly efficient, i.e., high and moderately efficient in the long and short term, respectively, but turned out to be less efficient following the eruption of the global financial crisis, thus revealing important implications in terms of asset allocation and risk diversification dealing with the Islamic markets.

On the other hand, Alam et al. (2016) reported similar patterns of efficiency among conventional and Islamic counterparts in the short term. However, over the long term, higher efficiency was revealed in the Islamic sectoral indices for the last decade. The efficiency of the Islamic stock market is further supported by Rizvi et al. (2014), who revealed the important impact of the improvement on the 'stage of market development' on the efficiency of the market. Similarly, Al-Khazali and Mirzaei (2017) discovered that Islamic indices attained higher efficiency over 1996-2015, notably during periods of financial crisis. Ali et al. (2018) indicated that shariah-compliant regulations, good governance, and disclosure mechanisms made Islamic stock markets more efficient than their conventional counterparts and had a speedier adjustment to speculative activity from 2003 to 2016. Based on the index families of Dow Jones, Financial Times, Standard & Poor's, and Morgan Stanley, El Khamlichiet et al. (2014) documented an equal level of efficiency among the Islamic and conventional indices based on the variance ratio test over a range of data from 1998 to 2011. The study on the impact of COVID-19 on stock market efficiency is relatively rare. Vasileiou (2020) investigated the reaction of the S&P 500 index to the news on COVID-19 from February 2020 to April 2020 based on the financial analysis and runs tests. The study found that the US stock market did not always incorporate the available information in time and was not always efficient during the COVID-19 outbreak.

3. Data and Methodology

The data adopted in this study is the daily closing price for two Islamic stock indices of the Bursa Malaysia, i.e., the FTSE Bursa Malaysia Hijrah Shariah Index (HJR) and the FTSE Bursa Malaysia EMAS Shariah Index (ES). The daily data was obtained from the DataStream database and spanned from October 9, 2019, to August 11, 2020. To better explain the random walk behavior of the stock market, this study categorizes the data into three observation periods: the pre-COVID-19 period, which started from October 9, 2019, to March 10, 2020; the COVID-19 period, which started from March 11, 2020, when COVID-19 was declared by the WHO as a pandemic, to August 11, 2020; and the entire period covering data from October 9, 2020, to August 11, 2020. Dividing the dataset into pre-

COVID-19 and COVID-19 with the same number of observations enables the study to have a symmetrical number of observations to examine the random walk behavior of a stock market.

In this study, the daily returns on the indices were calculated using the continuously compounding method by taking the first difference in the natural logarithm of the daily closing price for the indices:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

where R_t denotes the daily stock index return, ln denotes the natural logarithm, P_t and P_{t-1} denote the daily closing price for the indices in days *t* and *t-1*.

3.1. Unit Root Tests

This study employed unit root tests to examine the random walk behavior of the stock returns. A return series that has a unit root is said to be non-stationary, thus following a random walk and being weakly informationally efficient. This study employed the Augmented Dickey-Fuller Test (Dickey & Fuller, 1979, 1981), the Phillips-Perron Test (Phillips & Perron, 1988), and the Kwiatkowski et al. Test (1992) to examine if the market return has unit root property and is stationary.

3.1.1 Augmented Dickey-Fuller Test

The Augmented Dickey-Fuller (ADF) test was applied to determine the existence of unit roots in the return series. If unit root is present in the return series, the ADF test provides evidence that the selected market index returns are not stationary and follow a random walk process. Given the following ADF regression,

$$\Delta R_t = \alpha_1 + \beta R_{t-1} + \alpha_2 t + \sum_{i=1}^{p} \gamma_i \Delta R_{t-i} + \mu_t \quad (2)$$

where R_t denotes stock return at time t, ΔR_t denotes changes in the series R_t, R_{t-1} denotes lagged value for R, t denotes time or trend variable, α, β and γ denote regression coefficients, p denotes the lag order, and μ denotes the error term. The ADF regression examines the null hypothesis of a unit root by estimating an autoregression of the changes in the series R_t, i.e., ΔR_t, on its own lags, R_{t-1} using ordinary least squares regression.

3.1.2 Phillips-Perron Test

The Phillips-Perron test (PP) is a refinement of the Dickey-Fuller (DF) test, which controls for the serial correlation in the error terms without adding lagged difference terms. This test is expressed as follows:

$$t_{\alpha}^{\sim} = t_{\alpha}(\frac{\gamma_0}{f_0})^{\frac{1}{2}} - \frac{T(f_0-\gamma_0)(s.e.(\hat{\alpha}))}{2f_0^{\frac{1}{2}}s} \quad (3)$$

where t_{α} denotes the t-ratio of α , γ_0 denotes the consistent estimate of the error variance, f_0 denotes the estimator of the residual spectrum at frequency zero, $\hat{\alpha}$ denotes the estimate $s.e.(\hat{\alpha})$ and s denotes the standard error of the coefficient and standard error of the test regression. The asymptotic distribution of the PP test is similar to the ADF test. However, the PP test has an advantage over the ADF test in that it is a non-parametric test that does not require the user to specify the level of serial correlation. Similar to the ADF tests, PP examines the null hypothesis of a unit root.

In this study, rejection of the null hypothesis in ADF and PP indicates that there is no unit root in the return series. In other words, the return series does not follow a random walk. This further suggests that the stock return is not weak form informational efficient. Conversely, if the study fails to reject the null hypothesis, it shows that there is a unit root in the return series, and such a series follows the random walk process. This suggests that the stock return is weak form efficient.

3.1.3 Kwiatkowski, Phillips, Schmidt, and Shin Test

Kwiatkowski et al. (1992) (KPSS) introduced this test to circumvent the problem of low power unit root tests. The KPSS testing procedure differs from ADF and PP tests as it postulates the null hypothesis of stationary against the alternate hypothesis of a unit root. This test decomposes the time series into the sum of a deterministic time trend, a random walk, and a stationary error term. The null hypothesis specifies that the variance of the random walk component is zero. The computation of this test involves conducting an auxiliary regression, Y_t based on an intercept and a time trend t. The residual e_t from an OLS is saved, and the partial sum $S_t = \sum_{s=1}^{t} e_s$ is calculated for all t. The KPSS statistic is expressed as follows:

$$KPSS = T^{-2} \sum_{t=1}^{T} S_t^2 / \hat{\sigma}^2 \quad (4)$$

where $\hat{\sigma}^2$ is an estimator for the long-run variance, $\sigma^2 = \sum_{j=-\infty}^{\infty} E\{\varepsilon_t \, \varepsilon_{t-j}\}$. This estimator is a weighted average of the proposed sample autocovariance and several alternative weighting schemes.

According to KPSS, the rejection of the null hypothesis in the present study indicates that the return series is not stationary. In other words, the return follows a random walk process, and the stock market is weakly efficient. Alternatively, if the study fails to reject the null hypothesis, it indicates that the return series is stationary and does not follow a random walk process, thus suggesting that stock return is not weak form efficient.

3.2. Variance Ratio Tests

The random walk behavior of stock returns is further investigated based on the variance ratio tests (VR) developed by Lo and MacKinlay (1988), the wild bootstrap variance ratio of Kim (2006), and rank scores introduced by Wright (2000).

3.2.1 Lo and MacKinlay Variance Ratio Test (LMVR)

The Lo and MacKinlay variance ratio test (LMVR) assume that under a random walk, the variance increases linearly in the data interval. In other words, if a stock return follows a random walk, the variance of a *k*-period return is *k* times the variance of a one-period return.

Let SP_t be the stock price at time *t*, and let R_t be the random walk series derived by taking the difference in the natural logarithm of SP_t. Thus, the variance ratio, VR(*k*), is defined as the ratio of 1/*k* times the variance of the *k*-period return to the variance of the one-period return given as follows:

$$VR(k) = \frac{\sigma^2(k)}{\sigma^2(1)} \quad (5)$$

where $\sigma^2(k)$ is 1/*k* times the variance of the *k*-period return, i.e., R_t - R_{t-k} and $\sigma^2(1)$ is the variance of the one-period return, i.e., R_t -R_{t-1}. Following the conditional heteroscedasticity nature of financial time series, including stock returns, this study adopts a heteroscedasticity robust test statistic suggested by Lo and MacKinlay (1988) as follows:

$$M_{htr}(R;k) = (VR(R;k) - 1)[2(2k-1)(k-1)(3kT)^{-1}]^{-1/2} \quad (6)$$

Under the null hypothesis of a random walk, the variance ratio is not statistically different from 1 for all values of k. This study employed both the individual and joint tests of the VR. The individual VR test examines the null hypothesis of VR(k) =1 for a particular holding period, while the joint VR test observes the null hypothesis over several different holding periods.

3.2.2 Wild Bootstrap Variance Ratio Test (WB)

Kim (2006) introduced a wild bootstrapping approach to improve the small sample properties of the variance ratio test. The bootstrap distribution is formed by repeating steps (i): formulating a bootstrap sample with observation T as $R_t^* = \eta_t R_t$ $(t = 1, \dots, T)$, where η is a random sequence with zero mean and unit variance; and (ii): computing $M_{htr}^*(r;k)$ from the $M_{htr}(r;k)$ statistic in step (i). This study adopts a standard normal distribution for η and the number of bootstrap irrigations for the simulation is set to 1000.

3.2.3 Rank-Score Variance Ratio Test (RS)

Wright (2000) proposed a nonparametric variance ratio test based on ranks and scores that is more powerful than the single variance test of Lo and Mackinlay. Given a return series R_t, and the rank of the return series, s(R_t), the rank scores are defined as follows:

$$s_{1t} = \left(\mathrm{s}(R_t) - \frac{T+1}{2}\right) / \sqrt{\frac{(T-1)(T+1)}{12}} \quad (7)$$

$$s_{2t} = \Phi^{-1}\left(\mathrm{s}(R_t)/(T+1)\right) \quad (8)$$

where s_{1t} denotes the standardized rank scores with sample mean 0 and variance equal to 1, s_{2t} denotes the inverse normal rank score with sample mean 0 and variance approximately equal to 1, and Φ denotes the standard normal cumulative distribution function of a random variable. Wright (2000) suggests the rank-score variance ratio test statistics, r_1 and r_2 are as follows:

$$r_1 = \left[\frac{(Tk)^{-1} \sum_{t=k+1}^{T} (s_{1t} + s_{1t-1} + \cdots + s_{1t-k})^2}{T^{-1} \sum_{t-1}^{T} s_{1t}^2} - 1 \right] x \ (2(2k - 1)(\mathrm{k} - 1)(3kT)^{-1})^{-1/2} \quad (9)$$

and,

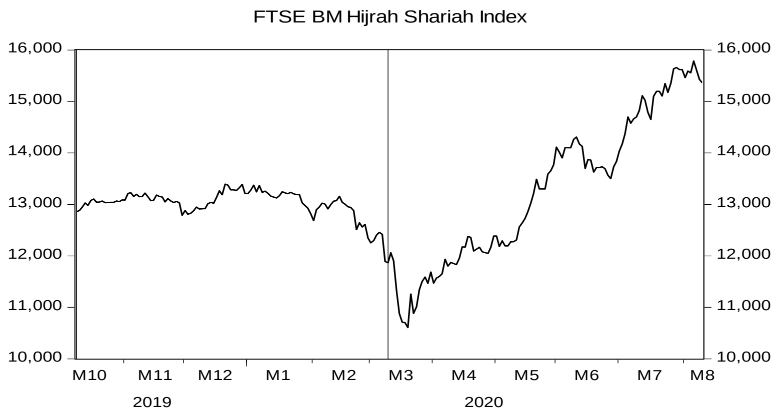
$$r_2 = \left[\frac{(Tk)^{-1} \sum_{t=k+1}^{T} (s_{2t} + s_{2t-1} + \cdots + s_{2t-k})^2}{T^{-1} \sum_{t-1}^{T} s_{2t}^2} - 1 \right] x \ (2(2k - 1)(\mathrm{k} - 1)(3kT)^{-1})^{-1/2} \quad (10)$$

To compute the rank scores, this study sets the number of bootstrap irrigations for the simulation to 1000.

4. Empirical Results

Figure 1 exhibits the price level of the stock market index.

Figure 1: FTSE Bursa Malaysia Hijrah Shariah Index (HJR)

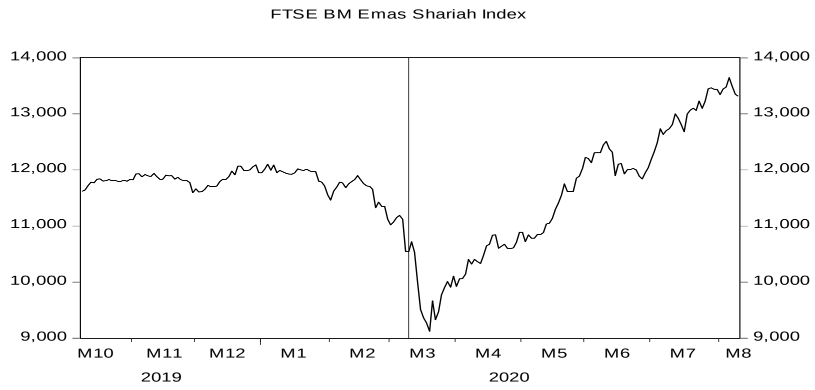


Source: Author's calculation.

Figure 1 plots the price level of the FTSE BM Hijrah Shariah Index (HJR) from October 9, 2019, to August 11, 2020. Data for pre-COVID-19 ranges from October 9, 2019, to March 10, 2020, while data during the period of COVID-19 ranges from March 11, 2020, to August 11, 2020. The figure shows that HJR moved between 12,000 and 13,000 points prior to the declaration of the COVID-19 pandemic on March 11, 2020. The index plunged into its lowest level of 10,607 on March 19, 2020, when the announcement on the Movement Control Order (MCO) was made by the

Malaysian government on March 18, 2020. Thereafter, the index started to bounce back and reached its highest point of 15,785 on August 7, 2020, but remained volatile during the observation periods.

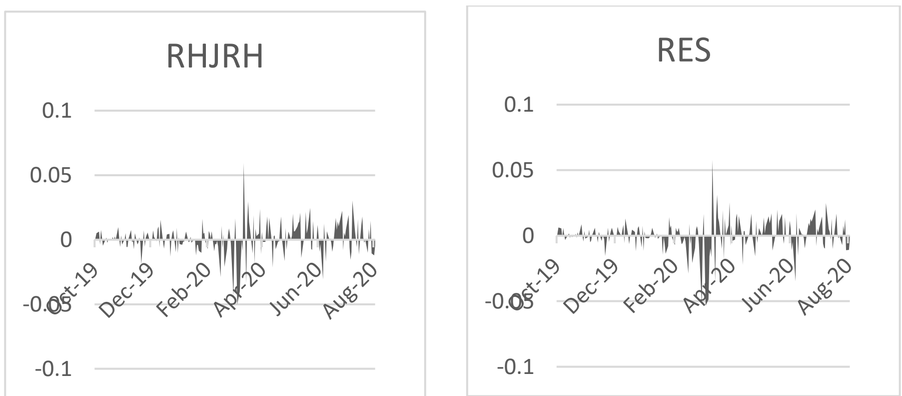
Figure 2: FTSE Bursa Malaysia Emas Shariah Index (ES)



Source: Author's calculation.

Figure 2 displays the data for the pre-COVID-19 and COVID-19 periods for the price level of the FTSE BM Emas Shariah Index (ES) from October 9, 2019, to August 11, 2020. The index fluctuated around 11,000 during the pre-COVID-19 period from October 9, 2019, to March 10, 2020. However, with the announcement of the COVID-19 pandemic and the MCO, the index dipped to its lowest level of 9120 on March 19, 2020, but steadily increased and reached its peak level of 13,497 on August 7, 2020.

Figure 3: Returns on HJR and ES



Source: Author's calculation.

Figure 3 depicts the daily log returns of HJR and ES over the 10-month observation periods. In the sample of pre-COVID-19, the returns for both indices moved between -0.2 and 0.2 ranges. The RHJR and RES experienced substantial volatility in March 2020 following the pandemic announcement on COVID-19 by the WHO and the adoption of the Movement Control Order in Malaysia. The peaks for the RHJR and RES indices, i.e., 0.0594 and 0.0579, were recorded on March 20, 2020, while the troughs, i.e., -0.0502 and -0.0533, were documented on March 13, 2020. Returns of both the indices were much higher and volatile during the period of COVID-19.

4.1. Descriptive Statistics of Returns on HJR and ES

Table 1. Descriptive Statistics of Returns on HJR and ES

	RHJR		
	Pre-COVID-19	COVID-19	Entire Period
Mean	-0.0008	0.0023	0.0008
Median	0.0000	0.0021	0.0000
Maximum	0.0163	0.0594	0.0594
Minimum	-0.0435	-0.0502	-0.0502
Std. Dev.	0.0079	0.0147	0.0119
Skewness	-1.9111	-0.1789	-0.2288
Kurtosis	11.081	5.6205	7.7867
Jarque-Bera	366.27***	32.061***	211.95***
	RES		
	Pre-COVID-19	COVID-19	Entire Period
Mean	-0.0009	0.0021	0.0006
Median	0.0000	0.0024	0.0003
Maximum	0.0140	0.0579	0.0579
Minimum	-0.0529	-0.0533	-0.0533
Std. Dev.	0.0081	0.0147	0.0120
Skewness	-2.9054	-0.5602	-0.7648
Kurtosis	18.146	6.5176	9.3902
Jarque-Bera	1206.24***	62.466***	395.77***

Source: Author’s estimation.

Note: RHJR denotes the return on the FTSE BM Hijrah Shariah Index, and RES denotes the return on the FTSE BM Emas Shariah Index. *** denotes significance at the 1% level.

Table 1 shows the descriptive statistics relating to the distribution of returns on HJR (RJHR) and returns on ES (RES) in three observation periods, i.e., pre-COVID-19, COVID-19, and the entire period. Remarkably, higher average daily returns, i.e., 0.0023 and 0.0021, were recorded for RHJR and RES during COVID-19 compared to the pre-COVID-19 period of -0.0008 and -0.0009. The maximum and minimum average returns reported in the COVID-19 period were larger than the pre-COVID-19 period for both RHJR and RES. In addition, the results of skewness and kurtosis showed that both the return series were far from normally distributed. The rejection of Jarque-Bera test statistics at the 1 percent significance level confirmed that the RHJR and RES were departures from normal distributions.

4.2. Unit Root Tests

Table 2: Results of the Unit Roots Tests for RHJR and RES

RHJR						
	Pre-COVID-19		COVID-19		Entire Period	
	Level	First Difference	Level	First Difference	Level	First Difference
ADF	-11.61***	-9.582***	-10.21***	-8.617***	-14.65***	-11.83***
PP	-11.72***	-47.69***	-10.21***	-87.71***	-14.66***	-101.6***
KPSS	0.115	0.204	0.073	0.204	0.101	0.115
RES						
	Pre-COVID-19		COVID-19		Entire Period	
	Level	First Difference	Level	First Difference	Level	First Difference
ADF	-10.80***	-9.530***	-9.910***	-7.313***	-14.02***	-13.26***
PP	-10.84***	-39.04***	-9.941***	-87.13***	-14.14***	-101.8***
KPSS	0.136	0.169	0.096	0.200	0.106	0.104

Source: Author’s estimation.
Note: RHJR denotes return on the FTSE Bursa Malaysia Hijrah Shariah Index; RES denotes the FTSE Bursa Malaysia Emas Shariah Index; ADF denotes the Augmented Dickey Fuller test; PP denotes the Phillip-Perron test; and KPSS denotes the Kwiatkowski, Phillips, Schmidt, and Shin test. *** denotes a significant value of 1%.

The results of unit root tests, i.e., ADF, PP, and KPSS, are reported in Table 2. The results of the ADF and PP tests demonstrated that the null hypothesis of a unit root is rejected at the 1 percent level of significance for both the RHJR and RES in the pre-COVID-19, COVID-19, and entire sample periods. For the KPSS test, the study showed that the null hypothesis of data stationarity cannot be rejected at the 1 percent level of significance in the observations of RHJR and RES, thus supporting the idea that the series do not follow a random walk process.

In sum, the findings of data stationarity and the absence of unit roots in both the RHJR and RES suggest that the return series do not follow a random walk process, thus providing evidence that the Islamic stock indices are not weak form efficient. In other words, the predictive content of past stock information is established, i.e., stock return at time *t-1* may be used to predict stock return at time *t*. This implies that it is possible for the participants in the stock market to devise a statistical technique to gain from the stock market transactions.

4.3. Variance Ratio Tests

Table 3 shows the results of the variance ratio test for RHJR based on the Lo and MacKinlay variance ratio test (LMVR), the wild bootstrap variance ratio test (WB), and the rank score variance ratio test (RS) tests. In the LMVR, the study examined the possible heteroscedasticity impact. Under the null hypothesis of a random walk, the variance ratio is expected to equal 1. The selected lags (k) considered for all the variance ratio tests are $k = 2, 4, 8$, and 16. For WB and RS, the number of bootstrap irrigations for the simulation is set to 1000.

For the individual test, the results indicated that random walk hypotheses were rejected at the 5% significance level for the LMVR test except for lag 16 in the pre-COVID-19 and COVID-19 periods, which were significant at the 10% level. Nonetheless, the null hypotheses of random walk were rejected for all lags in the individual variance ratio tests for WB and RS in the three observation periods. The results further showed that the null hypothesis of a random walk for all the joint tests was rejected at the 5% level of significance in the series of pre-COVID-19, COVID-19, and the entire period.

Table 3: Results of the Variance Ratio Test for RHJR

VR					
k	2	4	8	16	Joint test
Pre-COVID-19	0.4144 (0.0004)	0.2022 (0.0025)	0.1072 (0.0115)	0.0630 (0.0531)	3.5510 (0.0015)
COVID-19	0.4969 (0.0058)	0.2625 (0.0122)	0.1388 (0.0281)	0.0683 (0.0735)	2.7573 (0.0231)
Entire Period	0.5007 (0.0020)	0.2463 (0.0130)	0.1474 (0.0460)	0.0709 (0.0360)	3.4565 (0.0022)
WB					
k	2	4	8	16	Joint test
Pre-COVID-19	0.4144 (0.0000)	0.2022 (0.0010)	0.1072 (0.0015)	0.0630 (0.0022)	3.5510 (0.0030)
COVID-19	0.4969 (0.0020)	0.2625 (0.0130)	0.1388 (0.0460)	0.0683 (0.0360)	2.7573 (0.0280)
Entire Period	0.5007 (0.0005)	0.2463 (0.0013)	0.1474 (0.0070)	0.0709 (0.0331)	3.4565 (0.0160)
RS					
k	2	4	8	16	Joint test
Pre-COVID-19	0.4601 (0.0000)	0.2327 (0.0000)	0.1029 (0.0010)	0.0611 (0.0010)	5.636 (0.0000)
COVID-19	0.5304 (0.0000)	0.2874 (0.0000)	0.1667 (0.0030).	0.0773 (0.0090)	4.9027 (0.0000)
Entire Period	0.5313 (0.0000)	0.2742 (0.0000)	0.1719 (0.0000)	0.0954 (0.0030)	6.9367 (0.0000)

Source: Author’s estimation.
Note: LMVR denotes the Lo and MacKinlay variance ratio test; WB denotes wild bootstrapping; RS denotes rank scores; RHJR denotes return on the FTSE Bursa Malaysia Hijrah Shariah Index; *k* denotes lag; and parentheses denote a probability value.

Table 4 reports on the results for RES by employing the variance ratio tests. It revealed that random walk hypotheses were rejected at the 5% significance level for all lags in LMVR, WB, and RS except lag 16 for the LMVR test during the COVID-19 period. The results for joint tests in all periods supported the conclusion that the RES did not follow random walk behavior, as shown by the rejection of the null hypothesis of random walk in the LMVR, WB, and RS tests.

Table 4: Results of the Variance Ratio Test for RES

LMVR					
k	2	4	8	16	Joint test
Pre-COVID-19	0.4267 (0.0050)	0.2041 (0.0123)	0.1077 (0.0277)	0.0625 (0.0781)	2.8044 (0.0200)
COVID-19	0.4784 (0.0103)	0.2714 (0.0262)	0.1428 (0.0485)	0.0683 (0.1020)	2.5671 (0.0404)
Entire Period	0.5030 (0.0022)	0.2575 (0.0049)	0.1533 (0.0168)	0.0755 (0.0574)	3.0622 (0.0088)
WB					
k	2	4	8	16	Joint test
Pre-COVID-19	0.4267 (0.0000)	0.2041 (0.0000)	0.1077 (0.0060)	0.0625 (0.0090)	2.8044 (0.0010)
COVID-19	0.4784 (0.0050)	0.2714 (0.0160)	0.1428 (0.0460)	0.0683 (0.0480)	2.5671 (0.0290)
Entire Period	0.5030 (0.0000)	0.2575 (0.0040)	0.1533 (0.0290)	0.0755 (0.0700)	3.0622 (0.0230)
RS					
k	2	4	8	16	Joint test
Pre-COVID-19	0.5091 (0.0000)	0.2550 (0.0000)	0.1213 (0.0010)	0.0764 (0.0040)	5.1253 (0.0000)
COVID-19	0.5273 (0.0000)	0.2885 (0.0000)	0.1514 (0.0010)	0.0679 (0.0090)	4.9352 (0.0000)
Entire Period	0.5458 (0.0000)	0.2859 (0.0000)	0.1774 (0.0000)	0.0951 (0.0030)	6.7208 (0.0000)

Source: Author's estimation.
Note: LMVR denotes the Lo and MacKinlay variance ratio test; WB denotes wild bootstrapping; RS denotes rank scores; RES denotes return on the FTSE Bursa Malaysia Emas Shariah Index; *k* denotes lag; and parentheses denote a probability value.

4.4. Results and Discussion

The empirical results of the study concluded that the RHJR and RES did not follow the random walk process before and during COVID-19, as well as for the entire observation period according to the LMVR, WB, and RS tests. The results pointed out that current stock prices have not fully incorporated past information. The stationarity of the stock return further suggests that RHJR and RES are predictable based on individual and joint tests, thus they are not weak form efficient. Furthermore, the study found that stock returns were much higher and more volatile in the period of COVID-19 compared to pre-COVID-19 and the entire period.

The results of this study are consistent with the findings of Rehman et al. (2018) as well as Shaik and Maheswaran (2017), who found the predictability of stock returns and weak form inefficiency in emerging countries, including Malaysia. However, the findings of this study are not consistent with those of Mensi et al. (2017) and Alam et al. (2016), who suggest that Islamic indices are weak form efficient. As well, this study is not in line with the findings of Al-Khazali and Mirzaei (2017) and Rizvi et al. (2014) that Islamic indices achieve a higher efficiency level during the occurrence of crises.

5. Conclusion

This study examines the impact of COVID-19 on the random walk behavior of the emerging Islamic stock market. The analysis of the study is conducted by using the two Islamic stock indices of Malaysia, namely the FTSE Bursa Malaysia Hijrah Shariah Index (HJR) and the FTSE Bursa Malaysia EMAS Shariah Index (ES), over the period of October 9, 2019, to August 11, 2020. The study employed three unit root tests, i.e., the Augmented Dickey-Fuller (ADF) test, the Phillips-Peron (PP) test, and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test, as well as three variance ratio tests, i.e., the Lo and MacKinlay (1988) variance ratio test (LMVR), the wild bootstrap variance ratio (WB) of Kim (2006), and the rank scores (RS) of Wright (2000), to examine the random walk behavior. The results showed that Islamic stock indices did not follow the random walk process prior to and during COVID-19, as well as for the entire periods. This suggests that the emerging Islamic stock market is not weak form efficient. On the other hand, the study further found that returns for HJR and ES were much higher during the period of COVID-19. However, the results of the study must be interpreted with caution due to the relatively small sample size.

5.1. Implications

The findings of this study have several implications. The stationarity of returns of Islamic indices suggests that it is possible for investors to gain an excess return even during the period of the COVID-19 pandemic, which may help them diversify investment risk. This is further supported by the higher return of the Islamic stock indices during the COVID-19 period. The findings of inefficient weak form Islamic stock indices suggest that stock market regulators may undertake policies to develop the stock market and improve information dissemination in the Islamic stock market to promote more efficient resource allocation.

5.2. Future Research

This study is limited to two Islamic stock indices of an emerging market and takes the sample data from October 9, 2019, to August 11, 2020. Thus, more emerging Islamic stock markets and longer observation periods should be considered in the future study to produce more detailed results. Besides, more advanced methodologies such as the multifractal detrended fluctuation analysis may be considered to provide a more precise explanation of the weak form market efficiency.

Acknowledgements

The author thanks the editor and the anonymous referee for their valuable suggestions.

References

Al-Khazali, O., & Mirzaei, A. (2017). Stock market anomalies, market efficiency and the adaptive market hypothesis: Evidence from Islamic stock indices. *Journal of International Financial Markets, Institutions and Money*, *51*, 190-208.

Alam, N., Arshad, S., & Rizvi, S. A. R. (2016). Do Islamic stock indices perform better than conventional counterparts? An empirical investigation of sectoral efficiency. *Review of Financial Economics*, *31*, 108-114.

Ali, S., Shahzad, S. J. H., Raza, N., & Al-Yahyaee, K. H. (2018). Stock market efficiency: A comparative analysis of Islamic and conventional stock markets. *Physica A: Statistical Mechanics and Its Applications*, *503*, 139-153.

Al Samman, H., & Akkas, E. (2021). Assessing the Effects of COVID-19 on Stock Markets in the GCC Countries: Evidence from Sector-wise Panel Data Analysis. *Journal of Economic Cooperation & Development*, *42*(3), 133-166.

Aslam, F., Ferreira, P., Ali, H., & Kauser, S. (2021). Herding behavior during the COVID-19 pandemic: A comparison between Asian and European stock markets based on intraday multifractality. *Eurasian Economic Review*, 1-27.

Borges, M. R. (2010). Efficient market hypothesis in European stock markets. *The European Journal of Finance*, *16*(7), 711-726.

Bouoiyour, J., Selmi, R., & Wohar, M. E. (2018). Are Islamic stock markets efficient? A multifractal detrended fluctuation analysis. *Finance Research Letters*, *26*, 100-105.

Charles, A., & Darné, O. (2009). The random walk hypothesis for Chinese stock markets: Evidence from variance ratio tests. *Economic Systems*, *33*(2), 117-126.

Chaudhuri, K., & Wu, Y. (2003). Random walk versus breaking trend in stock prices: Evidence from emerging markets. *Journal of Banking & Finance*, *27*(4), 575-592.

Chen, C. P., & Metghalchi, M. (2012). Weak-form market efficiency: Evidence from the Brazilian stock market. *International Journal of Economics and Finance*, *4*(7), 22-32.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366a), 427-431.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica: Journal of the Econometric Society*, *49*(4), 1057-1072.

El Khamlichi, A., Sarkar, K., Arouri, M., & Teulon, F. (2014). Are Islamic equity indices more efficient than their conventional counterparts? Evidence from major global index families. *Journal of Applied Business Research (JABR)*, *30*(4), 1137-1150.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, *25*(2), 383-417.

Fama, E. F., & French, K. R. (1988). Permanent and temporary components of stock prices. *Journal of Political Economy*, *96*(2), 246-273.

Hassan, M. K., Hossain, S., & Ahmed, H. (2022). Impact of Islamic Finance on Economic Growth. *Journal of Economic Cooperation & Development*, *43*(2), 101-128.

Hidayah, N., & Swastika, P. (2022). Performance of Conventional, Islamic, and Social Responsible Investment (Sri) Indices During COVID-19: A Study Of Indonesian Stock Market. *Journal of Islamic Monetary Economics and Finance*, *8*(4), 517-534.

Irfan, M., Shaikh, Z. H., & Sarea, A. (2022). The Threshold Effect of COVID-19 on Shariah Indices: An Empirical Analysis of GCC Countries. *Journal of Economic Cooperation & Development*, *43*(1), 1-24.

Jawadi, F., Jawadi, N., & Cheffou, A. I. (2015). Are Islamic stock markets efficient? A time-series analysis. *Applied Economics*, *47*(16), 1686-1697.

Jawadi, F., Jawadi, N., & Louhichi, W. (2014). Conventional and Islamic stock price performance: An empirical investigation. *International Economics*, *137*, 73-87.

Karasiński, J. (2020). The Changing Efficiency of the European Stock Markets. *Annales Universitatis Mariae Curie-Skłodowska, Sectio H–Oeconomia*, *54*(1), 41-51.

Khan, M. A., Aman, Q., & Khan, N. (2016). Technical Analysis: Concept or Reality? *Pakistan Business Review, 18*(3): 732-751.

Khrapko, V. (2013). Testing the weak-form efficiency hypothesis in the Ukrainian stock market versus those of the USA, Russia, and Poland. *Ekonomika*, *92*(2), 108.

Kim, J. H. (2006). Wild bootstrapping variance ratio tests. *Economics Letters*, *92*(1), 38-43.

Kwiatkowski, D., Phillips, P. C., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, *54*(1-3), 159-178.

Lahmiri, S. (2013). Do MENA stock market returns follow a random walk process?. *International Journal of Industrial Engineering Computations*, *4*(1), 165-172.

Lee, K. Y. M., Jais, M., & Chan, C. W. (2020). Impact of COVID-19: Evidence from Malaysian Stock Market. *International Journal of Business and Society*, *21*(2), 607-628.

Lo, A. W., & MacKinlay, A. C. (1988). Stock market prices do not follow random walks: Evidence from a simple specification test. *The Review of Financial Studies*, *1*(1), 41-66.

Malkiel, B.G. (2003). The efficient market hypothesis and its critics. *Journal of Economic Perspectives*, *17* (1), 59-82.

Mensi, W., Tiwari, A. K., & Yoon, S. M. (2017). Global financial crisis and weak-form efficiency of Islamic sectoral stock markets: An MF-DFA analysis. *Physica A: Statistical Mechanics and its Applications*, *471*, 135-146.

Mukherji, S. (2011). Are stock returns still mean-reverting?. *Review of Financial Economics*, *20*(1), 22-27.

Neifar, M., & Gharbi, L. (2022). Weak EMH and Canadian stock markets: evidence from linear and nonlinear unit root tests. *Journal of Islamic Accounting and Business Research*, (ahead-of-print).

Pervez, M., Rashid, H. U., Chowdhury, M. A. I., & Rahaman, M. (2018). Predicting the Stock Market Efficiency in Weak Form: A Study on Dhaka Stock Exchange. *International Journal of Economics and Financial Issues*, *8*(5), 88-95.

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335-346.

Rehman, S., Chhapra, I. U., Kashif, M., & Rehan, R. (2018). Are stock prices a random walk? An empirical evidence of Asian stock markets. *ETIKONOMI*, *17*(2), 237-252.

Rizvi, S. A. R., Dewandaru, G., Bacha, O. I., & Masih, M. (2014). An analysis of stock market efficiency: Developed vs Islamic stock markets using MF-DFA. *Physica A: Statistical Mechanics and its Applications*, *407*, 86-99.

Sánchez-Granero, M. A., Balladares, K. A., Ramos-Requena, J. P., & Trinidad-Segovia, J. E. (2020). Testing the efficient market hypothesis in Latin American stock markets. *Physica A: Statistical Mechanics and its Applications*, *540*, 123082.

Saiti, B., Bacha, O. I., & Masih, M. (2014). The diversification benefits from Islamic investment during the financial turmoil: The case for the US-based equity investors. *Borsa Istanbul Review*, *14*(4), 196-211.

Sensoy, A., Aras, G., & Hacihasanoglu, E. (2015). Predictability dynamics of Islamic and conventional equity markets. *The North American Journal of Economics and Finance*, *31*, 222-248.

Shaik, M., & Maheswaran, S. (2017). Market efficiency of ASEAN stock markets. *Asian Economic and Financial Review*, *7*(2), 109.

Tay, B. H. (2019). The Informational Efficiency of Stock Market: An Unrestricted Error Correction Model. *International Journal of Accounting*, *4*(19), 86-97.

Tiwari, A. K., & Kyophilavong, P. (2014). New evidence from the random walk hypothesis for BRICS stock indices: a wavelet unit root test approach. *Economic Modelling*, *43*, 38-41.

Vasileiou, E. (2020). Efficient Markets Hypothesis in the time of COVID-19. *Review of Economic Analysis*, *13*(1), 46-63.

Wright, J. H. (2000). Alternative variance-ratio tests using ranks and signs. *Journal of Business & Economic Statistics*, *18*(1), 1-9.