Testing weak form efficiency of the Egyptian and Saudi stock markets

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Testing weak form efficiency of the Egyptian and Saudi stock markets

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Abstract

This research examines the weak-form efficiency in the Egyptian (ESE) and Saudi (SSE) Stock Markets. A set of parametric and non-parametric tests detect linear serial dependence in the two markets. We test the data for daily, weekly, and monthly data between January 1, 2000, and February 28, 2023, of two composite indices (EGX30 for ESE and TASI for SSE). Normality is tested using Skewness, Kurtosis, Jarque-Bera, Kolmogorov-Smirnov (K.S.) and Studentized Range tests, whereas random walk is tested using the non-parametric Runs test. Stationarity is tested using Augmented Dickey-Fuller (ADF), Phillips-Perron (P.P.) and KPSS tests. The empirical results indicate that the two stock market returns are abnormal. It doesn't behave randomly under the Runs test based on daily frequencies but randomly based on a monthly frequency. The two stock market returns are stationary.

Keywords: Egyptian stock market, Saudi stock market, efficient market hypothesis, randomness, unit root.

1. Introduction

Market efficiency theory suggests that the market is rational and provides correct pricing. Weak market efficiency is the lowest efficiency and only requires that past prices and returns cannot be used as a predictive tool for future returns. However, technical analysis is still widely used by traders and speculators who steadily refuse to consider the market a fair game and survive with such belief. EMH tests are applied in most developing countries. The conclusions of the studies have been mixed (even inside the same country), some supporting the EMH and others not in support.

This research aims to investigate the weak form of market efficiency of the Egyptian stock market (ESE) and the Saudi stock market (SSE). The daily/ weekly/ monthly closing prices of the two market indices (Egx30 for ESE) and (TASI for SSE) are analyzed from January 1, 2000, to February 28 2023.

To examine the weak-form market efficiency, I will first test the randomness of stock prices. If the stock market is found to conform to the random walk hypothesis, it can be concluded to be weak-form efficient.

Since the pioneering work by Fama (1965, 1970), the efficient market hypothesis (EMH) has become one of the most controversial and well-studied propositions in quantitative finance. Market efficiency theory suggests that the market is rational and provides correct pricing. The security prices tend to fluctuate randomly around their intrinsic values, return quickly towards equilibrium, and fully reflect the latest information available. This means that investment strategies based on past information in such markets cannot consistently earn positive abnormal returns over extended periods.

Weak market efficiency is the lowest efficiency and only requires that past prices and returns cannot be used as a predictive tool for future returns. Evidence obtained from developed markets suggests that stock markets in these countries are efficient, at least in the weak form. Most stock markets in emerging markets are not weak or efficient.

2. Previous literature

Abdelzaher M (2021) examines the Egyptian stock market (market efficiency assumptions) by studying the presence of time series properties for daily stock returns between 2005 and 2015 (which was converted into a series of monthly returns). She infers that the Egyptian stock market follows the inefficient form, showing that the price changes are not random. Thus, there may be shares presented at less than their actual value. Additionally, market participants can achieve unusual returns by using historical prices of shares.

Ananzeh I (2021) investigates the efficiency of a group of Arab stock markets located in the Middle East and North Africa (MENA) region according to the Random Walk Hypotheses (RWH) at weak form. The study covered the markets of Jordan, Egypt, Saudi Arabia, UAE, Bahrain, and Oman. The empirical results of all tests used in this study rejected the RWH at a weak form for all markets through all tests applied.

Dias and Santos (2020) examine the efficient market hypothesis, in its weak form, in 6 African stock markets (including Egypt) in the period from September 2, 2019, to September 2, 2020, to find out if the global pandemic (Covid-19) has decreased the efficiency of these markets. The stock markets analyzed were inefficient, with no differences between them.

Kelikume et al. (2020) investigated the weak axiom of the efficient market hypothesis (EMH) as it applies to fifteen (15) leading stock markets in Africa with the wavelet unit root analysis tool. They found that institutional constraints have implications for the efficient market hypothesis and investment in the African stock market.

El-Ansary O and Mohssen D (2017) examine the efficiency of the ESE. The empirical results revealed that the Egyptian stock market is inefficient as returns are dependent and don't follow a random walk.

Al Ashikh, Abdullah I. (2012) examines the weak form of EMH and the day-of-the-week effect in SSE using a linear approach. He rejected EMH and found evidence of day-of-the-week effects.

Al-Saleh, Nadhem, Al-Ajmi, and Jasim (2012) applied traditional and newer econometric techniques to test EMH in SSE of eight industry-based indices and a composite index. They found that the random walk hypothesis is rejected for some tests and accepted for others.

Budd (2012) examines the Efficient Market Hypothesis (EMH) and Random-walk Hypothesis (RWH) using the Variance-ratio test and Runs tests for seventeen sectors of the SSE between April 2007 and May 2011. RWH is rejected for all sectors.

Salameh et al. (2011) examined EMH in twelve Arab Stock Markets (including ESE and SSE). They found that the Saudi Arabia Stock Exchange is the only stock market that behaves randomly under the serial autocorrelation test and the run test. On the other hand, none of the twelve Arab stock exchanges behave randomly under the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (P.P.) unit root tests.

Onour (2009) examines several statistical tests on individual and sectoral price indices and the Saudi Stock Exchange Market aggregate price index. The results of the tests reject the hypothesis of the random walk at all levels of stock price indices.

Al_Abdulqader et al. (2007) examine the weak form of the efficient market hypothesis (EMH) for 45 companies in SSE. They consider whether patterns are present in share returns so investors can outperform the market by trading based on historical information. The results suggest that while there is some evidence of predictability in share returns, the EMH is more robust than in previous studies.

Simons and Laryea (2006) investigate the weak form of the efficient market hypothesis for four African stock markets – Ghana, Mauritius, Egypt and South Africa. Concerning Egypt, they found the returns are not normal and inefficient.

Abraham et al. (2002) showed that the inferences drawn from tests of market efficiency are rendered imprecise in the presence of infrequent trading. The observed index in thinly traded markets may not represent the true underlying index value, so there is a systematic bias toward rejecting the efficient market hypothesis. When the observed indices are used, the RWH is firmly rejected.

Butler and Malaikah (1992) examine Saudi Arabia and Kuwait's stock returns. The Kuwaiti market is similar to other thinly traded markets in the proportion of individual stocks exhibiting statistically significant autocorrelations and price change runs. In contrast, all 35 Saudi stocks significantly depart from the random walk.

For inferential purposes, the previous research is compared according to the period of study, the tests, the frequency of the data and the results. The comparison is shown in Table 1.

Parameter Study	Index(es)	Period (frequency)	Tests of WF-EMH or R.W. (results)	Tests of Stationarity / U.R. (results)	Normality test (results)
Abdelzaher (2021)	the general index of the Egyptian stock market, EGX30	2005-2015 (monthly data)	S.C. + L-B Q + runs test (rejected)	ADF + PP (stationary)	J-B (rejected)
Ananzeh (2021)	6 MENA countries (include Eg. And S.A.)	2009-2019 (daily data)	VRT + runs test (rejected for all)	ADF + PP (stationary)	S, K (rejected)
Dias and Santos (2020)	6 African stock markets (include Egypt)	2019-2020	VRT	LLC (not stationary)	---
Kelikume et al. (2020)	15 leading stock markets in Africa (include Eg.)	2010-2018\ (monthly data)	VRT (rejected for all)	Wavelet Unit Root Test (stationary)	Mixed res. (normal for Eg.)
El-Ansary and Mohssen (2017)	EGX30	2005-2016 (daily data)	L-B Q + VRT+ runs test (rejected)	---	---
Al Ashikh (2012)	TASI + Banks sector + 3 companies (SABIC, STC, SAVOLA)	1999-2010 (daily data)	S.C. + L-B Q + runs test (rejected)	ADF + PP + KPSS (stationary)	J-B (rejected)
Al-Saleh and Al-Ajmi (2012)	TASI + 8 industry-based indices	1994-2007 (daily and weekly)	SC + runs test (mixed results) WVRT + WB + CD + Chen-Deo	ADF + PP + KPSS (mixed results)	J-B (rejected)
Budd (2012)	TASI + 17 sectors	2007-2011 (daily data)	VRT + runs test (rejected for all)	---	J-B (rejected)
Salameh et al. (2011)	ESE+SSE + 10 Arabian stock markets	2009-2010 (daily data)	S.C. + runs test (rejected except for TASI)	ADF + PP (all 12 markets are stationary)	J-B (rejected)

Table 1: A comparison among previous studies in the Saudi Stock Exchange (part 2)

Parameter Study	Index(es)	Period (frequency)	Tests of WF-EMH or R.W. (results)	Tests of Stationarity / U.R. (results)	Normality test (results)
Onour (2009)	TASI + Banks sector + 3 companies (SABIC, STC, SAVOLA)	2003-2006 (daily data)	VRT (rejected at all levels)	ADF + P.P. + KPSS (stationary at all levels)	J-B (rejected)
Al-Khazali et al. (2007)	8 MENA countries	1994-2003 (weekly data)	VRT + runs test + WVRT + BDSL (rejected)	---	J-B (rejected)
Simons and Laryea (2006)	the EFG index (Egypt)	7:2:1997 to 6:25:2003 (weekly data)	SC + runs test + VRT (rejected)	---	S + K + St. R. (rejected)
Abraham et al. (2002)	Saudi Arabia, Kuwait, Bahrain	1992-1998 (weekly data)	VRT + runs test (rejected)	---	J-B (rejected)
Butler and Malaikah (1992)	Individual stocks Saudi+Kuwati markets	1985-1989 (daily data)	S.C. + runs test (not rejected for ESE and rejected for Kuwait)	---	---

Note: TASI= the general index for Saudi Arabia, MENA=Middle East and North Africa, UR= unit root, RW=random walk, WF-EMH=weak form efficient market hypothesis, SC= serial correlation coefficient, L-B Q=Ljung-Box Q-statistic (1978), ADF= Augmented Dickey and Fuller (1981) VRT=variance ratio test, PP= Phillips and Perron (1988); KPSS = Kwiatkowski, Phillips, Schmidt, and Shin (1992), CD= Chow and Denning (1993), WB= Wild Bootstrap, JB=Jarque-Bera's test of normality, S=skewness, K=Kurtosis, st. R.=studentized range, LLC=Levin panel, Lin, and Chu (2002) for stationarity , (MENA)= the Middle East and North Africa region.

3. Data and Methodology

Data

Egypt (ESE) and KSA (SSE) are the most extensive stock markets in the Middle East. The composite index of SSE is TASI, while ESE has four indices: EGX30, EGX50, EGX70, and EGX100. EGX30 index has been selected as it is the oldest and most popular index for investors and traders in the ESE. It includes the most active 30 traded companies of all the listed ones.

Daily, weekly, and monthly returns from January 1 2000 to February 28 2023, for the ESE and SSE are used in this study. The data is downloaded from sa.investing.com.

Objectives

This research aims to examine the weak-form efficiency of ESE and SSE. Hence, all the tests performed in this research are to address the question of whether the ESE and the SSE are efficient in the weak form or not.

Hypotheses

The hypotheses of the study are:

a) Normality

H_{01}: *The returns of the ESE main stock index are normally distributed*
H_{A1}: *The returns of the ESE main stock index are not normally distributed,*
H_{02}: *The returns of the SSE main stock index are normally distributed*
H_{A2}: *The returns of the SSE main stock index are not normally distributed,*

b) Weak-form efficiency

H_{03}: *The returns of the ESE main stock index follow a random walk/ is a weak-form efficient*
H_{A3}: *The returns of the SSE main stock index do not follow a random walk,*
H_{04}: *The returns of the ESE main stock index follow a random walk/ is a weak-form efficient*
H_{A4}: *The returns of the SSE main stock index do not follow a random walk,*

c) Stationarity

H_{05}: *The returns of the ESE main stock index are stationary*
H_{A5}: *The returns of the ESE main stock index are not stationary,*

H_{06}: The returns of the SSE main stock index are stationary,

H_{A6}: The returns of the SSE main stock index are not stationary,

Table 2 shows the null and the alternative hypotheses for each test used in this research in more detail.

Table 2: the null and the alternative hypotheses of testing the research assumptions

test of	name	type	H_0	$H_{.A.}$
Normality	Jarque-Bera (J.B.)	Parametric	Returns are normally distributed	Returns are not normally distributed
	Studentized Range [Fama]			
	K.S.	Non-parametric		
Randomness	ACF	Parametric	successive price changes are independent (random walk)	successive price changes are not independent (do not follow random walk)
	Runs	Non-parametric	the series is random	the series is not random
Stationarity (unit root)	ADF	Parametric (white noise error)	the time series has a unit root (not stationary)	no unit root (stationary)
	P.P.	Non-parametric (serially correlated and autoregressive error)		
	KPSS	Non-parametric	no unit root (stationary)	the series is not stationary

Variables

The variable used in this paper is the main stock market return r_t derived from the periodic indices (daily/weekly/monthly/yearly):

$$r_t = \ln(p_t / p_{t-1}) \qquad (1)$$

Where:
r_t = market return for period *t*,
p_t = market index for period *t,*
p_{t-1} = market index for period *t*-1,
ln = natural log.
The natural log transformation converts our data into continuously compounded rates. This practice is typical rather than using discrete compounding.

Normality

Normality of distribution is one of the basic assumptions underlying weak-form efficiency (Simons and Laryea, 2006). Therefore, before examining the randomness of stock prices, we test the normality assumption for each constituent for each frequency. The (parametric) serial autocorrelation and ADF tests are applied if returns are normally distributed. Otherwise, the (non-parametric) runs and P.P. tests are applied.
Normality is tested using skewness, the kurtosis and the Jarque-Bera (J.B.) test. Skewness is a measure of the asymmetry of the distribution of a series around its means. The coefficient of skewness of a symmetric distribution, such as the normal distribution, is (S=0). Then, positive skewness means that the distribution has a long right tail, and negative skewness implies that the distribution has a long left tail. Kurtosis measures the peakedness or flatness of the distribution of a return series. The Kurtosis of a normal distribution is (K=3). If the Kurtosis exceeds 3, the distribution is peaked (Leptokurtic) relative to the normal; if the Kurtosis is less than 3, the distribution is flat (Platykurtic) relative to normal.
Jarque-Bera (J.B.) test is a statistic for testing whether or not a series is normally distributed. It measures the difference of the skewness and Kurtosis of a series with those from a normal distribution of the sample of size *n* as:

$$JB = n\left[S^2/6 + (K-3)^2/24\right] \qquad (2)$$

Under the null hypothesis of normality in distribution, the J.B. is equal to 0. Positive or negative J.B. value indicates evidence against normality in series (Emenike Kalu, 2010).

Fama (1965) suggests that the studentized range is another test of the degree to which data deviates from normality. If the studentized range is greater than 6, then the null hypothesis of normal distribution is rejected.

The serial autocorrelation test and ACF

Serial correlation or autocorrelation is a popular test for randomness. It is a parametric test since it requires returns to be normally distributed. Pearson's correlation coefficient measures the relation between two random variables, x and y. In contrast, the autocorrelation coefficient measures the correlation degree between current and previous stock returns, which is separated by *k* lags, Campbell et al. (1997). It can be computed as follows:

$$\rho(k) = \frac{Cov(r_t, r_{t-k})}{\sqrt{Var(r_t)}\sqrt{Var(r_{t-k})}} = \frac{E[(r_t - \mu)(r_{t-k} - \mu)]}{E[(r_t - \mu)^2]} \qquad (3)$$

Where:

$\rho(k)$ = the autocorrelation coefficient between the successive returns for k lags,

r_t = the return at time *t,*

r_{t-k} = the past return at time *t-k,*,

$Cov(r_t, r_{t-k})$ = the covariance between the two returns,

$Var(r_t), Var(r_{t-k})$ = the covariances of the two returns.

Together, the autocorrelations at lags 1, 2, . . ., make up the autocorrelation function or *ACF*. Rather than scanning a list of numbers, plotting the autocorrelations against the lags is much easier. Such a plot is known as a *correlogram* and helps us visualize the ACF quickly and easily (a standard tool for exploring a time series before forecasting). An autocorrelation is significantly large if it outperforms the critical values (bands) of $\pm 2/\sqrt{T}$

where *T* is the sample size (Makridakis et al., 1997). The test is performed using Ljung—Box statistic, which follows the chi-square distribution with *m* degrees of freedom:

$$LB = n(n+2)\sum_{k-1}^{m}(\rho_k^2 / n-k) \square \chi_m^2 \qquad (4)$$

Where, $\widehat{\rho}_k$ = Auto-correlation coefficients at *lag k*,

n = Sample size.

The autocorrelation test expects the returns to be normally distributed. So, before applying the test, 'outliers' in the distribution must be removed. Hence, a normality test is performed.

Runs Test

The run test (or sign test) determines whether successive price changes are independent (Abraham et al., 2002). It is a non-parametric test, unlike the serial correlation parametric test of independence, since it does not require returns to be normally distributed (Fama, 1965). Each change in return was classified as positive (+), negative (−), or no change (0). The total number of expected runs of all types has been computed as:

$$m = \frac{\left[N(N+1) - \sum_{i=1}^{3} n_i^2\right]}{N} \qquad (5)$$

N is a count of the total number of return observations, and n_i is a count of price change in each category. For a large number of observations ($N > 30$), *m* approximately corresponds to a normal distribution with a standard error (σ_m) of runs as:

$$\sigma_m = \left[\sum_{i=1}^{3} n_i^2 \left\{\sum_{i=1}^{3} n_i^2 + N(N+1)\right\} - 2N\sum_{i=1}^{3} n_i^3 - N^3\right]^{\frac{1}{2}} \qquad (6)$$

The standard normal *Z*-statistic ($Z = (r-m)/\sigma_m$) can be used to test whether the actual number of runs is consistent with the independence hypothesis. When an actual number of runs exceeds (falls below) the expected runs, a positive (negative) Z value is obtained. A positive (negative) Z value indicates a negative (positive) serial correlation in the return series.

Stationarity

The Stock Markets Indices in finance should be stationary, which is necessary for RWH. Stationarity means that there is no growth or decline in the data. Several statistical tests have been developed to determine if a series is stationary. If the null hypothesis of a unit root in stock prices is rejected, consecutive prices over a period are stationary (which implies a random walk). These are also known as unit root tests (Makridakis et al., 1997). To test the existence of unit roots, the AugmentedDickey–Fuller (ADF) test (1979), the Phillips–Perron (P.P.) test proposed by Perron (1988) and Phillips and Perron (1988), or the procedure developed by Kwiatkowski et al. (1992) (KPSS) may be employed.

- (ADF): The ADF unit root test is performed by estimating the regression:

$$\Delta r_t = \gamma_0 + \gamma_1 r_{t-1} + \gamma_2 T + \sum_{T=1}^{m} \gamma_i \Delta r_{T-i} + \varepsilon_T \qquad (7)$$

Where Δr_t is the first difference of return, γ_0 is a constant, T is the trend term, Δr_{t-1} is the lagged dependent variable, γ are the coefficients to be estimated, and m is the number of lagged terms added to ensure that ε is a stochastic error term that has zero mean, constant variance σ^2, and is non-autocorrelated. It is also known as the white noise error term. The Akaike Information Criterion (AIC) test checks whether m is large enough to ensure that ε is a white noise error. MacKinnon's critical values are used to determine the significance of the test statistics associated with γ_0 (Al-Saleh and Al-Ajmi, 2012). The null hypothesis to inspect the unit root test is as:

$$H_0 : \gamma_0 = 0 \ versus \ H_1 : \gamma_0 < 0$$

- (P.P.): The Phillips–Perron (non-parametric) unit root test aims to correct the serial correlation and autoregressive heteroskedasticity of the error terms in the ADF test. The formula of The Phillips–Perron is:

$$\Delta r_{t} = \gamma_{t} + \beta r_{t-1} + + \xi_{t} \qquad (8)$$

- (KPSS): The third unit root test used is the KPSS procedure developed by Kwiatkowski et al. (1992). This test has the advantage of being specifically designed to test the null hypothesis of stationarity and a unit root as the alternative hypothesis. KPSS is calculated using the following function:

$$\eta_t = T^{-2} \sum_{t=1}^{T} S_t^2 \Big/ S^2 (L) \qquad (9)$$

Where L is the lag parameter, S_t is the cumulative sum of residuals (εt) from a regression of the series on a constant linear trend (i.e., $S_t = \sum \varepsilon_t$, t = 1, 2, 3,…, T) and

$$S^2(L) = T^{-1} \sum_{t=1}^{T} \varepsilon_t^2 + 2T^{-1} \sum_{s=1}^{L} (1 - S) / (L+1) \sum_{t=s+1}^{T} \varepsilon_t \varepsilon_{t-s} \qquad (10)$$

The null hypothesis of ADF and P.P. unit root tests is that the time series has a unit root (not stationary), and the alternative hypothesis is that the series is stationary. Therefore, test statistics of ADF and P.P. should be significant to have a stationary series. Conversely, the null hypothesis of KPSS is that the series is stationary, and the alternative is that the time series has a unit root (Al Ashikh, 2012).

4. The Empirical Results

Descriptive statistics

Table 3 presents the descriptive statistics of the daily/weekly/monthly/yearly log-returns of the two Arab markets, ESE and SSE. Interestingly, the two markets have positive mean returns during the study period for all frequencies. EGX30 mean 0.00022) exceeds TASI. EGX30 is again found to be a high-risk market (Figure 2). The two markets have a negative skewness. Another exciting aspect is that daily and weekly returns of both markets have leptokurtic (Kurtosis>2.58) distribution with flatter tails than normal distribution (Hair, Anderson, Tatham, Black, 2005), while monthly returns of both markets have Platykurtic distribution (Parkinson, 1987).

Table 3: Descriptive statistics for the returns of ESE and SSE (1 Jan.2000-28 Feb. 2023)

	Index Returns					
	Egypt (EGX30)			*KSA (TASI)*		
	Daily	*Weekly*	*Monthly*	*Daily*	*Weekly*	*Monthly*
Mean	0.00047	0.0023	0.0095	0.00026	0.0013	0.0058
Min.	-0.17992	-0.2195	-0.4033	-0.1033	-0.2384	-0.2977
Max.	0.18369	0.1932	0.3119	0.0939	0.1376	0.1790
Std.	0.01627	0.0401	0.0899	0.0136	0.0322	0.0691
Skewness	-0.39136	-0.5569	-0.2613	-0.9448	-1.3783	-0.8032
Kurtosis	8.87201	4.1475	2.1946	11.0224	8.4329	2.1489
n	5660	١١٩٦	276	6084	١١٦٧	276

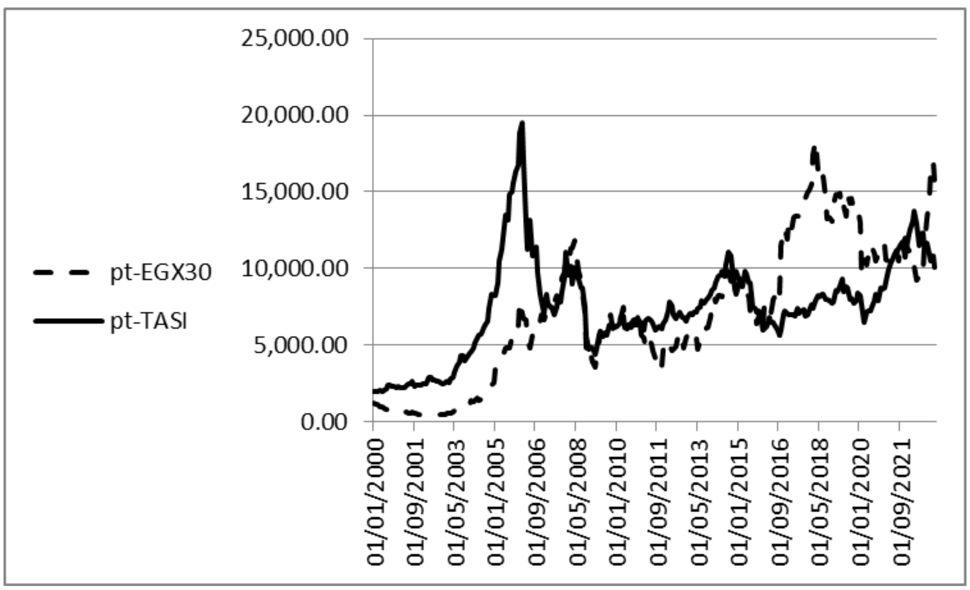

Figure 1: Time Series Plots of the EGX30 and TASI monthly stock prices from 1/2000 to 2/2023

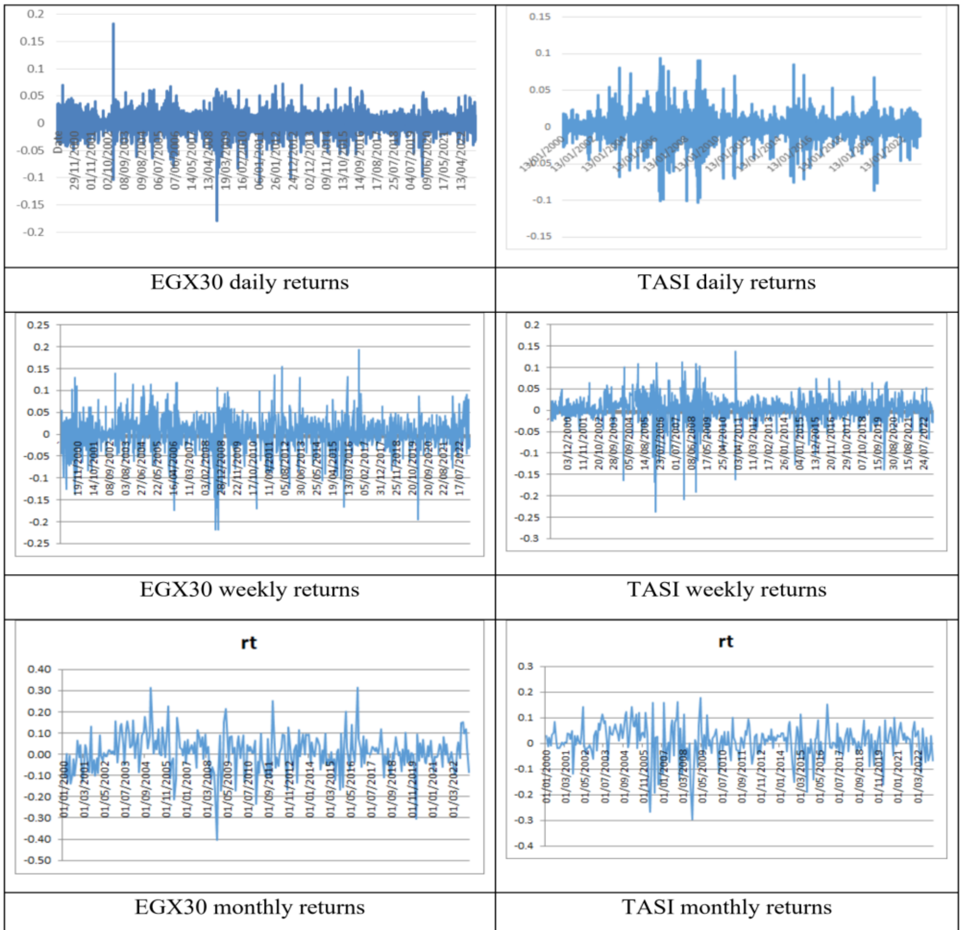

Figure 2: Time Series Plots of the EGX30 and TASI stock market returns between 1/1/2000-28/2/2023

Normality

The results of performing Jarque-Berra (J.B.) and studentized range and Kolmogorov-Smirnov (K.S.) tests for normality are shown in Tables 4 and 5, respectively. The null hypothesis that EGX30 and TASI returns are normally distributed is rejected in all tests. So, it could be stated that both markets do not follow a normal distribution.

Table 4: J.B. and studentized range results for testing of normality of EGX30 and TASI returns

	Index Returns					
	Egypt (EGX30)			*KSA (TASI)*		
	Daily	*Weekly*	*Monthly*	*Daily*	*Weekly*	*Monthly*
J.B.	8276	127	10.6	17220	18.4	38
p-value	(0.0000)	(0.0000)	(0.0049)	(0.0000)	(0.0000)	(0.0000)
St. range	22.33	10.30	7.96	14.62	11.67	6.89

Table 4: K.S. results for testing of normality of EGX30 and TASI returns

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of EGX30 daily returns is normal with mean 0.006 and standard deviation 0.01.	One-Sample Kolmogorov-Smirnov Test	.000	Reject the null hypothesis.
2	The distribution of TASI daily returns is normal with mean 0.004 and standard deviation 0.01.	One-Sample Kolmogorov-Smirnov Test	.000	Reject the null hypothesis.
3	The distribution of EGX30 weekly returns is normal with mean 0.015 and standard deviation 0.02.	One-Sample Kolmogorov-Smirnov Test	.000	Reject the null hypothesis.
4	The distribution of TASI weekly returns is normal with mean 0.011 and standard deviation 0.02.	One-Sample Kolmogorov-Smirnov Test	.000	Reject the null hypothesis.
5	The distribution of EGX30 monthly returns is normal with mean 0.038 and standard deviation 0.06.	One-Sample Kolmogorov-Smirnov Test	.000	Reject the null hypothesis.
6	The distribution of TASI monthly returns is normal with mean 0.029 and standard deviation 0.04.	One-Sample Kolmogorov-Smirnov Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Autocorrelation Test and ADF Test

Since the returns of our series were not normally distributed, the (parametric) serial autocorrelation and ADF tests can't be applied. Otherwise, the (non-parametric) runs and P.P. tests are applied.

Runs Test

The non-parametric runs test is applicable as a randomness test for the returns sequence. Accordingly, it tests whether returns in emerging market indices are predictable. The null hypothesis for this test is for temporal independence in the series (or weak-form efficiency). The results of the test are shown in Table 5. It has been found that the return series of the two countries is not random for daily frequencies and weekly frequencies for Egypt, but it behaves randomly based on monthly frequency.

Table 5: Runs test results for EGX30 and TASI returns

	Egy daily	KSA daily	Egy weekly	KSA weekly	Egy monthly	KSA monthly
Test Value[a]	.000810	.000895	.003600	.003500	.007000	.012400
Cases < Test Value	2830	3042	598	582	138	138
Cases >= Test Value	2830	3042	599	586	139	139
Total Cases	5660	6084	1197	1168	277	277
Number of Runs	2489	2806	544	552	147	128
Z	-9.093-	-6.077-	-3.210-	-1.932-	.903	-1.384-
Asymp. Sig. (2-tailed)	.000	.000	.001	.053	.366	.166

a. Median

P.P. and KPSS Tests

Stationarity in the return series is tested here using Phillips–Peron (P.P.) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests. The analysis results are shown in Table 6, showing that the two return series are stationary for the three frequencies.

Table 6: The results of P.P. and KPSS tests for EGX30 and TASI returns

		Daily returns		Weekly returns		Monthly returns	
		Egypt	Saudi	Egypt	Saudi	Egypt	Saudi
P.P.	Test Stat.	-65.41	-82.42	-32.34	-32.83	-14.15	-14.75
	Critical values	1% (-3.43), 5% (-2.86), 10% (-2.57)					
	Prob.	0.0001	0.0001		0.0000	0.0000	0.0000
	Bandwidth	22	36	12	13	8	7
KPSS	LM-Stat.	1.90	1.80	0.63	0.83	0.22	0.47
	Critical values	1% (0.74), 5% (0.36), 10% (0.35)					
	Bandwidth	26	38	13	14	9	8
N		5659	6083	1197	1168	277	277

The Phillips–Peron (P.P.) unit root test hypotheses are H_0: unit root, H_1: no unit root (stationary. The Kwiatkowski, Phillips, Schmidt and Shin (KPSS) unit root test hypotheses are H_0: no unit root (stationary), and H_1: unit root. The two tests: In level; Intercepts only in the series; Spectral estimation method: Bartllet Kernel; Automatic selection: Newy-West Bandwith.

5. Conclusion

This paper examines a) the normality, b) the existence of the random walk hypothesis (RWH) by testing the weak-form efficiency, and c) stationarity in the Egyptian Stock Exchange (ESE) and the Saudi Stock Exchange (SSE) returns using parametric and non-parametric linear tests. The data includes the two markets' daily, weekly and monthly close prices. It has been found the returns of the two markets are not normal for the three frequencies. It doesn't behave randomly under the Runs test based on daily frequencies, but it behaves randomly based on monthly frequencies. The two stock market returns are stationary.

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ملخص

يفحص هذا البحث كفاءة الشكل-الضعيف في سوقي الأسهم المصرية والسعودية. وقد تم استخدام مجموعة من الاختبارات المعلمية واللامعلمية لاكتشاف التبعية المتسلسلة الخطية في كلتا السوقين. وتم اختبار البيانات من ١ يناير ٢٠٠٠ حتى 28 فبراير ٢٠٢٣ لمؤشري السوقين المصرية (EGX30) والسعودية (TASI) المركبين بتكرار يومي وأسبوعي وشهري. وتم اختبار مدى تبعية العوائد للتوزيع الطبيعي باستخدام الالتواء والتفرطح واختبار "جارك-بيرا" واختبار المدى المعاير واختبار "كولموجوروف-سميرنوف"؛ بينما تم اختبار مدى تبعية العوائد للمشي العشوائي باستخدام اختبار المتتابعات اللامعلمي. وتم اختبار استقرار سلاسل العوائد باستخدام اختبارات "ديكي-فوللر المُعَزز" و "فيليب-بيرون" و KPSS لجذر الوحدة. وأشارت النتائج التجريبية إلى عدم تبعية العوائد في كلتا السوقين للتوزيع الطبيعي. وأنها -تحت اختبار المتتابعات- لا تتصرف عشوائياً استناداً التكرارات اليومية والأسبوعية، لكنها تصبح عشوائية إذا تم الاستناد على التكرار الشهري. .

الكلمات الدالة: سوق الأسهم المصرية، سوق الأسهم السعودية، فرضية كفاءة السوق، العشوائية، جذر الوحدة.