Are the Arabic Financial Markets Efficient Under The Weak Form?

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Résumé :

Cette étude examine l'hypothèse de marche aléatoire ou exactement la prévisibilité des rendements boursiers pour déterminer la validité de la forme faible de l'efficience pour un ensemble de marchés boursiers arabes. L'efficience des marchés financiers dépend de la rapidité avec laquelle le marché assimile de nouvelles informations. En forme faible de marché efficient, le prix actuel reflète toute l'information contenue dans le prix passé. Les résultats empiriques de cette étude montrent la non-normalité des distributions des rendements des indices boursiers arabes. Ils confirment aussi le caractère non aléatoire dans leur l'évolution, ce qui signifie le rejet de la forme faible de l'efficience informationnelle pour cet ensemble de marché.

JEL *classification* : C12, G1, G14, G15.

Abstract: This study examines the random walk hypothesis or exactly the predictability of stock returns to determine the validity of the weak form of the efficiency of a set of Arabs stock markets. The efficiency of financial markets depends on the speed which the market assimilates new information.

In weak form of efficient market, the current price reflects all the information contained in the past prices. The empirical results of this study show the non-normality of the return distributions on the Arab stock indexes selected in this study. They also confirm the non-randomness in their evolution, which means the rejection of the weak form of this set of market.
Keywords: Market efficiency, random walk, Auto correlation test for normality, serial correlation, unit root tests.

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1. Introduction

The capital market plays a strategic role in the economic growth of a country. It facilitates the exchange of funds between applicant and investor. The existence of a capital market allows a company to obtain another source of funding. In another way, it offers the investor the possibility to choose the investments according to their preference. The financial market thus has an essential and important role in the world economy. That is why it is at the heart of many empirical studies. The theme of the informational efficiency of the market has been hotly debated for over 50 years. Efficiency has been tested in the form of two related theories, namely the random walk and the efficient market hypothesis (EMH), the latter being hypothesis which has opened the way for so much research on the theory of capital markets.

Market efficiency is a relationship between the information and the process of stock prices. The random walk hypothesis can be attributed to Louis Bachelier (1900) in his thesis entitled " Speculation ". It assumes that prices are quite stochastic in nature, thus the market price of the shares cannot be predicted. Eugene F. Fama (1965) was the first to defined the term "efficient market" in financial literature describing it as a market where prices always completely reflect all the available information. A market is efficient if the reaction of market prices to the new information is instantaneous and unbiased.

According to Fama (1970), financial markets present three forms of informational efficiency as a function of the nature of the information which is incorporated into the prices. The market is the weak form of efficiency when the current price reflects the information from only past prices. The market is considered as having the semi-strong form of efficiency when the current price reflects the information provided from past prices as well as public information, and when there is no approach which being able to predict the use of this information. The market is said to have the strong form of efficiency when the current price reflects all public information, private as well as information contained in past prices.

After the article of the Eugene F. Fama (1991), several researchers tested the forms of efficiency on a set of financial markets. Chowdhury (1991) examined the efficiency of the market for four non-ferrous metals - copper, lead, tin, and zinc - traded in the London Metal Exchange (LME), by the application of cointegration tests. Bekaert and Hodrick (1992) sought to characterise the predictable components in the rates upper to the returns on the main stock markets of exchange rates (US, Japan, Germany, and the United Kingdom) by using returns excess delayed, dividend returns and the futures premiums as instruments. To do this they used vector autoregression models (VAR). On the French stock market, J. J. Lilti (1994) used cointegration to assess the variability of stock prices and the degree of market segmentation spot and future. Laurence Martin, *and al.* (1997) tested the weak form of efficiency of the two Chinese stock markets in Shanghai and Shenzhen and explore the statistical relationships and the causality between these Chinese stock markets with each other and with the US markets each and Hong Kong. The main purpose of the study Varamini and Kalash (2008) was to use the Sharpe ratio to test the efficient market hypothesis for different market capitalisations and investment styles of mutual funds, for the period 1994-2007, as well as two sub-periods (1994-1999 and 2000-2007) in the US market.

However, the markets of the Arab region have not been looked at as much in such studies because of the insufficient data and information, and due to the nature of Arab capital markets. Indeed, several problems can be identified:

- defects in the legislative and regulatory framework: Frequents issue of sometimes contradictory decisions, multiplicity of laws without consistency, heavy bureaucracy and restrictions on foreign investment;
- defects in the mechanisms of the Arab financial markets: ineffectiveness of brokers in the securities transactions, ineffectiveness of financial brokerage firms, absence of innovation in the tools of investment and savings;
- a lack of link between Arabic stock markets: informational restrictions such as weakness of the information system on the Arab stock markets , absence of a predictive information network on the indicators and lack of complete and accurate information in financial reports, financial restrictions such as taxes on the securities traded on the market and the impact of inflation on bonds.

This study focuses on the tests of the weak form of efficiency. The main objective of this study is to examine the efficiency of the capital market following the assumption of random walk or not. The research is divided into five sections. After the introduction in the first section, section two, consists of a review of the literature relative to the random walk and the efficiency of the market. Section three examines the data and the methodology of the study. Section four presents the results of the models and discussions there concerned finally section five proposes a conclusion which returns to the essential reports of this study.

2. Literature Review

The efficient market hypothesis (EMH) is of major importance in modern financial theory. Many studies have been conducted to understand the different levels of market efficiency. Unfortunately, the conclusions of these studies are often contradictory.

There are many research results concerning the efficiency in its weak form, in both developed and developing countries. Alexander (1961) is the first to have tested the nonlinear dependence between an industrial group, on two of the American stock markets (NYSE and Chicago). He concluded that spurious autocorrelation could be introduced by the mean and the random walk model corresponded best fits the data. He founds nevertheless a lepto-kurtosis in the distribution of the returns. Osborne (1962) investigated the deviations of stock prices on the NYSE from a simple random walk, and his results include the fact that stocks tend to be traded in concentrated propulsion. Still on the same market, Granger and Morgenstern (1963) performed a spectral analysis on the market prices and found that short-term movements of the series obey the simple random walk hypothesis, that the movements of long-term movements do not follow this random walk, and that the "business cycle" is not important. Godfrey, Granger and Morgenstern (1964) found no relationship between changes in weekly prices and volume. Rather, they noticed that the price changes followed a random walk.

Steiger (1964) tested the non-random process of stock prices and concluded that they did not follow a random walk. Fama (1965) concluded that the market price actions followed this random walk well. Otherwise, he explained how the random walk theory of the stock market prices present significant challenges for the partisans of both technical analysis and fundamental analysis. For his part, Samuelson (1965) provided the first formal economic argument of "efficient markets". His contribution is carefully summarised by the title of his article "Proof That Properly Anticipated prices Fluctuate Randomly." He focused on the concept of a martingale, rather than a simple random walk. Cooper (1982) examined the validity of the random walk hypothesis by using the correlation analysis, the Runs test and spectral analysis using monthly, weekly and daily data for 36 countries. De Bondt and Thaler (1985) found that the price of 35 stocks on the NYSE overreact and thus they noticed the inefficiency of the market. Lo and Mac Kinlay (1988) strongly rejected the random walk hypothesis for weekly stock market returns of the NYSE by using the test of variance-report. Jegadeesh (1990) documented solid proof of predictable behaviour of the stock returns and therefore rejected the random walk hypothesis. Chan and al. (1997) concluded, in turn, that the world stock markets are weak form.

Butler and Malaikah (1992) examined the stock returns in Saudi Arabia and Kuwait during the period from 1985 to 1989. They found autocorrelation statistically significant correlations for a large part of the individual actions of Kuwait. In contrast, the 35 Saudi actions showed a significant deviation from the random walk. The institutional factors that contributed to the inefficiencies in the market included lack of liquidity, fragmentation of the market, equity trading, deadline delays and the absence of officials responsible for the market. By using the auto-correlation test to study correlation in the series of stock returns, and by looking to identify factors which limit the efficiency of the Amman Stock Exchange, Mokabala and Barehoma (2002) found that stock prices in the banking sector do not follow a random walk. Unlike most previous studies in this field, and using the index of the Amman market for the period from 1993 to 2000, Fayoumi (2003) applied the methodology based on the correction effect of frequent trading in order to take into account the non-linear behaviour of the stock returns and market evolution. His results indicate the inefficiency of the Amman Stock Exchange until 1996, probably because of the characteristics of the market during this period. His results also show that there were important institutional, technical and organisational changes prior to 1996 that could have contributed to increased the efficiency of the market. Moustafa (2004) examined the behaviour of the daily stock prices for 43 securities included in the index of the UAE market for the period 2001 to 2003. The results show that some stock returns of the sample did not follow a normal distribution and that the returns of 40 of the shares were random at a significance level of 5%. Therefore, the empirical study supports the weak form EMH of the United Arab Emirates stock market. Using daily sectoral indexes in the four sectors of the Amman Stock Exchange between 1992 and 2004, a ratio of variance and Runs tests, Rawashdeh and Squalli (2006) found that the random walk hypothesis and the weak form of efficiency is rejected for all the sectors. Hokroh (2013) offers a more detailed investigation into the behavioural finance for daily index returns of the Saudi Arabian stock prices. In his study he used autocorrelation and random walk tests from 1st January 2007 to 18th+++ March 2007 (before Tadawul) and 19th March 2007 to 29 May 2007 (after Tadawul).

3. Methodology and Data

This study applies the tests on the normality of returns and the efficiency of the market for a set of Arab financial markets. The aim is to determine whether the time series of Arab stock returns are predictable or not by attempting to determine whether these returns follow a random walk model. The empirical analysis is based on daily, weekly, and monthly data on the indexes of Arab markets namely:

- The ADX of the United Arab Emirates,
- The EGX30 of Egypt,
- The MASI of Morocco,
- The QE of Qatar,
- The TADAWUL of Saudi Arabia, and
- The TUNINDEX of Tunisia.

The period covered by this study is from 1st January 2007 to 16th June 2014. The database was constructed from the base of Thomson Reuters data. The returns on the daily, weekly and monthly indexes were calculated as follows:

$$R_{i,t} = Ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right), \qquad (1)$$

where:

- $R_{i,t}$ is the market return for country i at time t,
- $I_{i,t}$ represents the value of the stock market index i at time t.

The equation of the random walk process with a drift is:

$$R_{i,t} = c + R_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Where $\varepsilon_{i,t}$ is a white noise process. Using random walk models means that the efficiency of financial markets can be accepted or rejected. If the efficiency of financial markets is accepted, means that the market price of the actions cannot be predicted. This study seeks to test the random walk hypothesis for the Arab stock markets, against the alternative, the efficiency of the weak form of these markets is not accepted.

These random walk models assume that stock returns follow a normal distribution. As a consequence, the Jarque-Bera test and Anderson-Darling test were chosen to test the normality of the series of Arab stock returns. The Anderson-Darling test is a nonparametric test considered as a variant of the Kolmogorov-Smirnov test, with the difference that gives more importance to the tails of the distribution. The normality test of Jarque-Bera is also based on the coefficients of skewness and kurtosis. It assesses the simultaneous deviations of these coefficients with the reference values of normal distribution. Serial correlation is apprehended via the Ljung-Box test based on the autocorrelation coefficients. The Ljung-Box tests if the auto correlations of a series, up to a given delay k, are different from zero over time. However, unit root tests should be performed to find whether the series are stationary or not. Thus, if a series is said to be qualified non-stationary, this implies the implementation of the efficient market.

4. Empirical results and discussions

The empirical results, stemming from the use of the software EVIEWS 7.2, are classified according to the different statistical techniques used for all the Arab stock exchanges conducted in this study for the period from January 2007 to June 2014 on daily, weekly, and monthly data.

4 a. Descriptive statistics and normality

Table 1 presents a statistical description for all the series of index returns of six Arab stock exchanges. It can be seen that, except for the MASI index of Morocco, all the indexes have a positive average return. The QE index has the highest daily, weekly and monthly average returns (0.0006, 0.0031, and 0.0143, respectively). The MASI index presents the weakest values of average returns, and for the three types of series (daily, weekly and monthly), with negative values of -0.00007, -0.0001, -0.0012 respectively.

On the basis of the value of the standard deviation, the EGX30 index takes the greatest values whether it is by considering the daily, weekly, or monthly data (0.018, 0.0444 and 0.1003 respectively). The weakest values of the standard deviation are those of both indexes of the Maghreb countries, namely Morocco and Tunisia, with 0.0081 and 0.0062 respectively for daily data, 0.0186, 0.0171 respectively for weekly data, and .0394, 0.0401 for monthly data. On this basis, the MASI and TUNINDEX appear to be the least volatile, while the EGX30 index appears to be the most volatile.

4 b. The normality of returns

From the point of view of the normality of the distributions of returns for the stock market indexes studied, it was found that the skewness is negative for all indexes. This means that the heads of the distribution curves of returns bend towards the right, and that, therefore, most of the values of the indexes of all returns are above average, but with a small difference. However, there is less value below the average, but with a larger difference than those which are above the average. The smallest negative value is found in the EGX30 index, with a value of -1.1803 for the daily data, a value of -2.0488 in the ADX index for the weekly data, and -1.4893 for the QE index for the monthly data. For kurtosis all the values are above the value three, there is, therefore, certain concentration of the returns towards the average for all the indexes. For the daily and weekly data, the largest values of kurtosis can be found in the TUNINDEX index, with values of 14.2017 and 19.0734, for the daily and weekly data, respectively. On the other hand, these larger values of kurtosis are found in the QE index when the returns are calculated monthly. It is easy to see that the values of the kurtosis coefficients of all the indexes, for daily data, are higher compared to other data (weekly and monthly). In contrast, the values of the monthly skewness coefficients are the weakest. This phenomenon can be seen as a consequence of the low liquidity the Arab financial markets and their transactions. Strong values of kurtosis can be seen in all the equity markets, namely those of Qatar, the United Arab Emirates and Tunisia. This is not valid for the Moroccan stock market for monthly data. The values of skewness and kurtosis indicate that the returns of the stock market indexes studied were not normally distributed. After, attempts will be made to confirm this result from the tests of normality.

Table 1**. Descriptive statistics of daily, weekly and monthly index returns**

Indexes	N	mean	Maximum	Minimum	Standard deviation	Skewness	Kurtosis	Jarque-Bera	Anderson-Darling
United Arab Emirates (ADX)									
daily	1860	0.0002	0.0762	-0.0867	0.0113	-0.3069	12.3838	6853.583	47.5575
weekly	386	0.0012	0.1032	-0.2099	0.0301	-2.0488	14.9219	2556.020	7.8252
monthly	89	0.0059	0.1828	-0.1808	0.0622	-0.3820	4.3950	9.3886	0.9669
Egypte (EGX30)									
daily	1782	0.0001	0.0731	-0.1799	0.0180	-1.1803	11.9130	6312.3500	23.5094
weekly	380	0.0004	0.1552	-0.2195	0.0444	-1.1322	7.5642	411.0406	7.5506
monthly	88	0.0028	0.2403	-0.4033	0.1003	-0.8116	5.0943	25.7441	0.8009
Morocco (MASI)									
daily	1853	-0.00007	0.0446	-0.0466	0.0081	-0.3718	8.2405	2163.126	24.2278
weekly	387	-0.0001	0.0498	-0.0980	0.0186	-0.5988	6.5693	228.5729	4.6606
monthly	89	-0.0012	0.1009	-0.1136	0.0394	0.1181	3.3891	0.7686	0.4761
Qatar (QE)									
daily	1868	0.0006	0.0833	-0.0922	0.0132	-0.7317	13.6420	8981.610	77.2092
weekly	386	0.0031	0.1244	-0.0338	0.0338	-1.5775	13.6415	1981.4260	14.2331
monthly	89	0.0143	0.0170	-0.1765	0.0743	-1.4893	8.8431	159.5163	2.6410
Saudi Arabia (TADAWUL)									
daily	1856	0.0001	0.0908	-0.1032	0.0144	-0.9569	13.6649	9079.248	76.1560
weekly	376	0.0006	0.1376	-0.2086	0.0364	-1.1858	9.6866	788.6029	9.7915
monthly	89	0.0037	0.1789	-0.2977	0.0717	-0.8018	5.9807	42.4853	1.2191
Tunisia (TUNINDEX)									
daily	1837	0.0003	0.0410	-0.0500	0.0062	-0.6478	14.2107	9748.2320	47.8620
weekly	385	0.0016	0.0791	-0.1362	0.0171	-1.7710	19.0734	434.7330	10.8824
monthly	89	0.0063	0.0904	-0.1426	0.0401	-0.6441	4.9897	20.8357	1.0173

The table presents descriptive statistics (number of observations N, average, minimum, maximum value and standard deviation) and also the coefficients of skewness, kurtosis the normality tests (Jarque-Bera, Anderson-Darling) for the returns on six Arab financial markets, for daily , weekly, and monthly data, and for the period January 2007-June 2014.

The statistics calculated by Jarque-Bera and by Anderson-Darling which appear in Table 1, are used, to test the null hypotheses relative to the normality of the daily, weekly, and monthly data distributions of Arab index returns. All the calculated values of the Jarque-Bera statistics (except as regards the monthly return on the MASI index) are greater than the critical value of khi-two for 5% critical value. The Anderson-Darling test confirms the conclusions of the Jarque-Bera test, for a critical value at 5% which equals 0.752. Consequently, none of these series of returns is then well approximated by the normal distribution.

4 c. Serial correlations

If a market is efficient in the weak form, then there is no correlation between the successive prices. The auto-correlations are used to test the linear independence of random variables in a series. If any auto-correlation is not found in a series, then the series is considered random. If the returns are identically and independently distributed (IID), then all auto-correlations should be close to zero. To do this, the Ljung-Box test, which is a powerful test to test the random walk hypothesis, was used as it takes into account both the set of auto-correlations coefficients until a delay h. The formula of this test is given by:

$$Q_{LB} = n(n+2)\sum_{j=1}^{h}\frac{\hat{\rho}_j^2}{n-j} \qquad (3)$$

where:

- $\hat{\rho}_j$ is the autocorrelation of the sample in the lag,
- h is the total number of lags.

If $Q_{LB} > \chi^2_{h,1-\alpha}$, then, the random walk hypothesis is rejected.

The results of the first twelve coefficients of auto-correlations and the Ljung-Box statistics of daily, weekly, and monthly returns for each series of

Arab financial markets for the period from the 1st January 2007 to the 16th June 2014 are presented in Table 2.

For the daily data, the first two (three for some) coefficients of auto-correlations are positive, then become negative. This implies the non-predictability of daily returns of Arab financial markets, because the negative auto-correlation indicates the return to the average yields. For weekly data, a constant tendency of the positive auto-correlation can be seen clearly until lag five, for the EGX30, MASI, and TUNINDEX returns. In contrast, for monthly data, two indexes the ADX and QE have positive coefficients for lags 7 and 5 respectively.

The Ljung-Box statistics show that, for daily data, the null hypothesis of no auto-correlation is rejected for all the index returns of Arab markets, in the lags from 1 to 12, and for the 99% and 95% of significance level. The same thing can be noted for the weekly data, but only for the returns of EGX30, MASI, QE, and Tadawul except for lags 8 and 9. The null hypothesis is, however, accepted at a 5% level, for the last two indexes, the ADX and TUNINDEX. Thus, the Ljung-Box statistic shows that the null hypothesis auto-correlation independence is rejected from the lag 6 for the ADX index, and from the lag 11 for the index TUNINDEX. Similarly, for the monthly data, the hypothesis of the random walk hypothesis is accepted for the EGX30, the MASI, the EQ (only at 1% error level for lags 1, 6, 7, 8, 9, 10, 11, and 12 for QE) and Tadawul. The results show that the hypothesis according to which the distribution of returns of Arab indexes is independent and identically distributed is rejected for all the series in six markets. The random walk hypothesis is accepted for time series EGX30 and MASI at 1% and 5% and it is accepted at 1% only for time series for QE and Tadawul.

Table 2. **The values of the autocorrelation coefficient and Statistics Ljung-Box test**

Indexes		ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	ρ_9	ρ_{10}	ρ_{11}	ρ_{12}
ADX	D	0.228	0.051	-0.024	-0.027	-0.007	-0.029	-0.051	-0.003	0.012	-0.031	0.019	0.009
		(97.16)	(102.0)	(103.0)	(104.5)	(104.6)	(106.1)	(111.0)	(111.0)	(111.3)	(113.1)	(113.8)	(114.0)
	W	-0.004	-0.053	0.100	0.114	0.108	0.085	0.033	0.107	0.015	0.037	0.107	0.016
		(0.007)	(1.122)	(5.030)	(10.15)	(14.77)	(17.64)	(18.07)	(22.61)	(22.70)	(23.24)	(27.85)	(27.96)
	M	0.329	0.253	0.119	0.006	0.052	0.004	0.015	-0.088	-0.121	-0.138	-0.099	0.033
		(9.965)	(15.92)	(17.25)	(17.26)	(17.52)	(17.52)	(17.54)	(18.32)	(19.81)	(21.77)	(22.78)	(22.89)
EGX30	D	0.189	0.037	0.033	-0.016	0.018	-0.004	-0.047	-0.004	-0.004	0.047	0.010	0.042
		(63.88)	(66.36)	(68.30)	(68.73)	(69.28)	(69.31)	(73.27)	(73.30)	(73.32)	(77.30)	(95.43)	(98.57)
	W	0.063	0.055	0.049	0.028	0.067	0.034	-0.063	0.079	0.035	-0.035	-0.021	0.032
		(1.505)	(2.648)	(3.571)	(3.880)	(5.619)	(6.064)	(7.630)	(10.06)	(10.54)	(10.74)	(10.92)	(11.31)
	M	0.187	-0.005	0.138	0.139	0.048	-0.227	-0.046	-0.031	-0.102	-0.187	-0.199	-0.065
		(3.169)	(3.171)	(4.947)	(6.762)	(6.978)	(11.95)	(12.16)	(12.25)	(13.30)	(16.85)	(20.94)	(21.38)
MASI	D	0.244	0.036	-0.071	-0.056	-0.029	-0.029	-0.022	-0.013	-0.015	0.014	0.029	0.017
		(110.2)	(112.7)	(122.1)	(128.1)	(129.6)	(131.2)	(132.1)	(132.4)	(132.9)	(133.2)	(134.8)	(135.3)
	W	0.017	0.021	0.041	0.019	0.086	0.066	-0.054	-0.019	0.083	-0.048	0.036	-0.088
		(0.115)	(0.290)	(0.964)	(1.101)	(3.983)	(5.684)	(6.856)	(6.993)	(9.768)	(10.69)	(11.21)	(14.35)
	M	0.029	0.095	-0.099	0.191	-0.049	0.133	-0.131	-0.077	-0.063	0.143	0.058	-0.015
		(0.077)	(0.920)	(1.849)	(5.329)	(5.564)	(7.281)	(8.963)	(9.557)	(9.954)	(12.06)	(12.40)	(12.42)
QE	D	0.196	0.094	0.006	-0.048	-0.024	-0.014	-0.032	0.038	-0.010	-0.014	0.026	0.030
		(72.20)	(88.68)	(88.74)	(93.14)	(94.26)	(94.65)	(96.56)	(99.20)	(99.40)	(99.78)	(101.0)	(102.7)
	W	0.023	0.055	0.073	-0.012	0.077	0.099	-0.048	0.151	-0.006	0.051	-0.060	0.030
		(0.201)	(1.366)	(3.464)	(3.520)	(5.853)	(9.749)	(10.65)	(19.63)	(19.65)	(20.68)	(22.13)	(22.49)
	M	0.240	0.027	0.151	0.099	0.008	-0.237	-0.135	-0.136	-0.166	-0.089	0.053	-0.026
		(5.287)	(5.355)	(7.492)	(8.427)	(8.434)	(13.91)	(15.72)	(17.57)	(20.38)	(21.18)	(21.47)	(21.54)
TADAWUL	D	0.089	0.056	0.004	-0.013	0.029	-0.026	-0.029	-0.025	0.029	-0.044	0.071	0.010
		(14.79)	(20.63)	(20.66)	(20.97)	(22.55)	(23.83)	(25.39)	(26.53)	(28.53)	(31.69)	(41.22)	(41.40)
	W	-0.045	0.006	0.134	-0.057	0.039	-0.062	0.066	0.052	-0.096	0.070	0.033	-0.094
		(0.780)	(0.796)	(7.681)	(8.914)	(9.497)	(10.96)	(12.63)	(13.68)	(17.21)	(19.14)	(19.53)	(22.99)

	M	0.139	0.069	-0.046	-0.057	-0.045	-0.073	-0.185	-0.010	0.084	-0.084	-0.210	-0.060
		(1.781)	(2.222)	(2.423)	(8.914)	(5.112)	(5.631)	(8.999)	(9.009)	(9.717)	(10.43)	(15.01)	(15.38)
TUNINDEX	D	0.265	0.091	0.018	-0.009	-0.020	-0.065	-0.067	0.027	0.059	0.036	0.062	0.007
		(129.6)	(145.0)	(145.6)	(145.7)	(146.4)	(154.2)	(162.4)	(163.7)	(170.1)	(172.5)	(179.6)	(179.6)
	W	0.054	0.079	0.026	0.112	-0.068	-0.082	0.099	-0.026	0.018	-0.003	0.160	-0.057
		(1.149)	(3.562)	(3.836)	(8.752)	(10.58)	(13.24)	(17.10)	(17.36)	(17.49)	(17.50)	(27.75)	(29.05)
	M	0.082	-0.014	0.196	0.101	-0.092	-0.136	0.058	0.009	-0.094	0.070	-0.044	0.034
		(0.615)	(0.633)	(4.262)	(5.231)	(6.056)	(7.866)	(8.199)	(8.206)	(9.093)	(9.598)	(9.801)	(9.923)

This table shows the results of the first twelve coefficients of the autocorrelation of the sample and their statistics of Ljung-Box test (.) To daily returns (D), weekly (W), and monthly data (M) on the indexes of the United Arab Emirates market (ADX), Egypt (EGX30), Morocco (MASI), Qatar (EQ), Saudi Arabia (Tadawul) and Tunisia (TUNINDEX) for a complete sample, for the period from January 2007-June 2014.

These analysis results of auto-correlation are consistent with the previous conclusions on the markets of Kirt C. Butler and S. J. Malaikah on the Saudi market and Walid Abdmoulah (2010).

4 d. Unit roots

The stationarity is fundamental in the implementation of the hypothesis of the market efficiency. To find the stationary, the unit root tests must be committed. In order to test the stationarity of the series, the Dickey and Fuller test (ADF) (a test for the unit root in a sample of time series) was used, by applying autoregressive (AR) models. The null hypothesis of this test is that the series is non-stationary (the series with a unit root $\phi_0 = 0$, or even more $\rho = 1$, with $\rho = 1 - \phi$). Dickey and Fuller propose three models to test the stationarity of a series. Let y_t is a time series of the type $AR(p)$:

$$\Delta y_t = \phi_0 y_{t-1} + \sum_{j=1}^{p} \phi_j \Delta y_{t-j} + \varepsilon_t \tag{4}$$

$$\Delta y_t = c + \phi_0 y_{t-1} + \sum_{j=1}^{p} \phi_j \Delta y_{t-j} + \varepsilon_t \tag{5}$$

$$\Delta y_t = c + \beta t + \phi_0 y_{t-1} + \sum_{j=1}^{p} \phi_j \Delta y_{t-j} + \varepsilon_t \qquad (6)$$

Before proceeding with the test, it is first necessary to determine the order of the delay (p) by using the Akaike information criterion (AIC), Schwarz (SIC) and Hannan-Quinn (HQ). The table 3 presents these information criteria. The implementation of the test is as follows: first of all the model is estimated 6) for each series of Arab markets and for each horizon (daily, weekly, and monthly data). Then testing is done to find the presence of the trend in the series. If the null hypothesis $(\beta = 0)$ is rejected, the null hypothesis is tested in the same model using $(c = 0)$ and $(\phi_0 = 0)$ respectively. However, if the null hypothesis $(\beta = 0)$ is accepted, model (5) is used. Then the null hypothesis is tested on the drift $(c = 0)$. If this hypothesis is rejected, the null hypothesis of a unit root $(\phi_0 = 0)$ is tested. In contrast, if it is the alternative hypothesis which is rejected, model (4) is then used. After estimating this model, the null hypothesis of a unit root $(\phi_0 = 0)$ is tested.

Table 3**. The information criteria AIC, SIC and HQ for the choice of lag,**

Indexes	ADX			EGX30			MASI			QE			TADAWUL			TUNINDEX		
Type of series	D	W	M	D	W	M	D	W	M	D	W	M	D	W	M	D	W	M
The maximum lag used	25	17	12	25	17	12	25	17	12	25	17	12	25	17	12	25	17	12
AIC	25	17	1	11	1	1	3	1	2	25	8	1	21	3	1	19	7	1
SIC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
HQ	19	5	1	1	1	1	3	1	1	2	1	1	2	1	1	1	1	1
Lag retained	25	17	1	1	1	1	3	1	1	25	1	1	21	1	1	1	1	1

To apply the information AIC, SIC, and HB criteria, a maximum lag was used, which is 24 for daily data, 16 for weekly data, and finally 11 for the monthly data. The decision in the choice of the lag was based on the idea that if these criteria are different, the one that gives most number of lags must be chosen to avoid any autocorrelation of residuals. In the case of two criteria which give the same lag value, the decision was to refer this lag for the series under consideration. The last line represents the decision for the lag of each series.

The results from Table 4 show that the series of stock indexes in the six markets are stationary in levels, whether at 1% or 5% threshold of the error. The ADF test rejects the null hypothesis for all thresholds of the index, which implies that all price indexes examined are stationary and cannot be represented as a random walk. This means that, the Share Returns are predictable. Therefore, by using the ADF test, it can be concluded that the Arab financial markets are not efficient in the weak form.

Table 4. **The unit root test of Dickey-Fuller for index returns of Arab financial markets**

Indexess	Type of series	N° of observations	β	c	ϕ
ADX	Daily	1860	0.092^{***}	0.650^{**}	-6.227^{*}
	Weekly	386	0.871^{***}	0.490^{**}	-3.774^{*}
	Monthly	89	0.958^{***}	0.593^{**}	-4.488^{*}
EGX30	Daily	1782	0.845^{***}	0.196^{**}	-34.740^{*}
	Weekly	380	-18.233^{***}	0.201^{**}	-18.246^{*}
	Monthly	88	0.710^{***}	0.141^{**}	-7.692^{*}
MASI	Daily	1853	$3.42e^{-07***}$	-0.146^{**}	-24.029^{*}
	Weekly	387	-1.332^{***}	-0.133^{**}	-19.276^{*}
	Monthly	89	-0.888^{***}	-0.355^{**}	-9.062^{*}
QE	Daily	1868	0.253^{***}	1.653^{**}	-7.975^{*}
	Weekly	386	0.134^{***}	1.287^{**}	-5.165^{*}
	Monthly	89	0.138^{***}	1.368^{**}	-7.077^{*}
TADAWUL	Daily	1856	0.782^{***}	0.417^{**}	-8.591^{*}
	Weekly	376	0.715^{***}	0.448^{**}	-9.816^{*}
	Monthly	89	1.196^{***}	0.196^{**}	-8.342^{*}
TUNINDEX	Daily	1837	-1.234^{***}	1.356^{**}	-8.270^{*}
	Weekly	385	-1.167^{***}	1.294^{**}	-6.640^{*}
	Monthly	89	-1.230^{***}	1.323^{**}	-8.402^{*}

The values of β, c and ϕ in the last three columns show the t-statistic calculated for each coefficient estimated in the three models presented above in equations (4), (5) , and (6) for the period from January 2007 to June 2014. (*) indicates the t-statistic of the estimated coefficients from model (4), (**) indicates the t-statistic of the estimated coefficients from model (5), (* **) indicates the t-statistic of the estimated coefficients from model (6).

5. Conclusion

The main objective of this study was to determine if the Arab stock markets, in some major Arab countries, have a weak form of efficiency or, in a different way, if they present a random walk. The period studied was from January 2007 to June 2014, which was marked by the world financial crisis. In order to achieve the objective a certain number of tests were used, namely normality tests (Jarque-Bera and Anderson-Darling), serial correlation tests (Ljung-Box), and unit root tests (ADF). The empirical results of the efficient market hypothesis, and exactly on the question of the normality of distributions of returns, under its weak form, indicate that returns are not independent and identically distributed according to both tests (Jarque-Bera and Anderson-Darling). The the Ljung-Box statistic shows a dependence on the level of auto-correlations coefficients, for the daily data, for all countries integrated in this study. This serial correlation is a consequence of the liquidity problem and the difficulty of valuing actions. However, the null hypothesis of independence is accepted for the weekly data, for both the EGX30 and MASI indexes for a threshold of 1% and 5%. The same is the case for the QE and Tadawul indexes, but only at 1%. Except that both indexes remain, namely ADX and TUNINDEX suffer always the problem of independence. The same conclusion can be fired, at the level of monthly data.

Finally, the unit root test of Dickey and Fuller (ADF) demonstrates the stationarity of all series of returns and at all levels, this implies the non-random walk of the returns, and, therefore, the refusal of the weak form efficiency in these markets. Consequently, stock prices can be predicted from its past values.

Overall, the results of this study show that the Arab stock markets are not efficient in the weak form. Because of the political environment (government intervention on the market a policy that economically), poor organisation of the market, and the ineffectiveness of dealers in securities transactions, all these problems may be the cause of market inefficiencies. In addition, these markets are highly sensitive to previous shocks indicating that undesirable shocks exert their influence over a long period.

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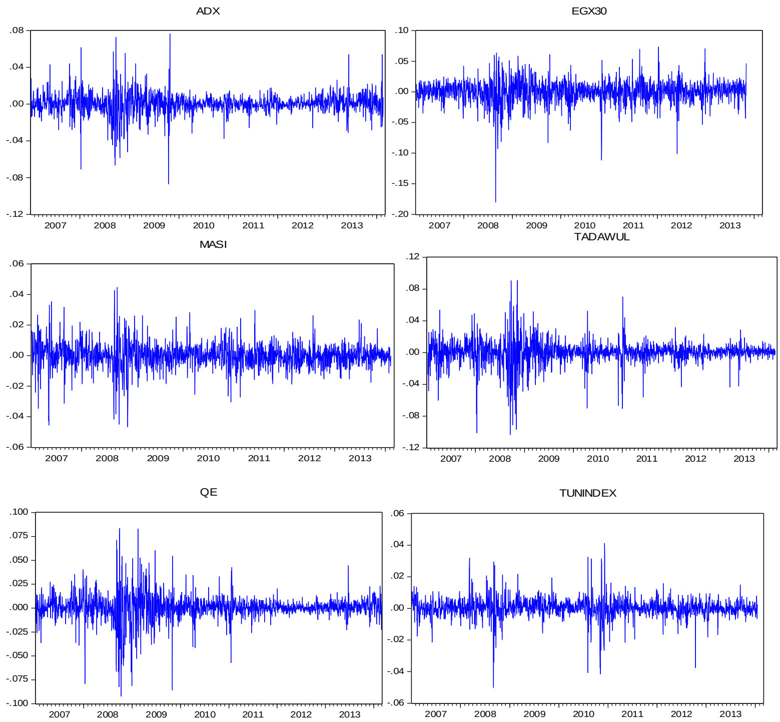
A 1. **Rendements des indices journaliers des marchés boursiers Arabes**



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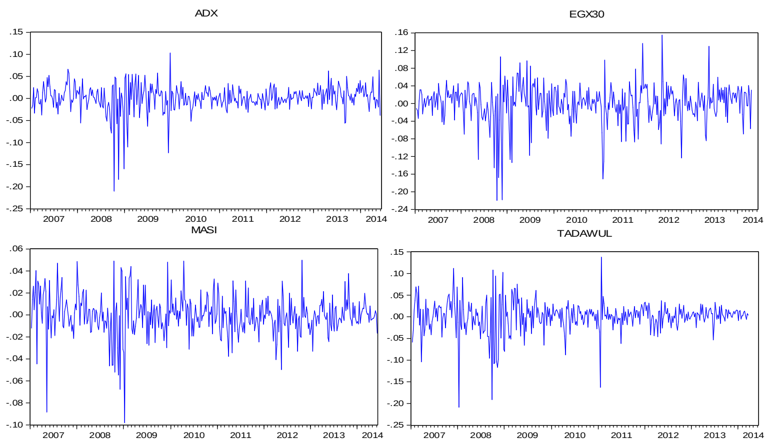

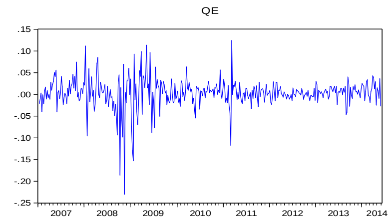

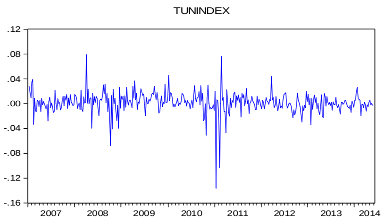

A 3. **Rendements des indices mensuelles des marchés boursiers Arabes**