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Are the Stock Markets in the Middle East Region Efficient?

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In this paper four emerging stock markets in the Middle East region, namely Egypt, Turkey, Jordan and Morocco, are analyzed to test whether they meet the criterion of weak-form stock market efficiency. Beside the conventional unit root tests, the study applies Perron's (1997) to test for a unit root in the presence of an unknown time of structural break. The results provide strong evidences that the stock price indices in these markets are characterized by a unit root and follow a random walk, which is consistent with the weak-form of efficient market hypothesis. The efficiency of these stock markets plays vital role in attracting foreign equity portfolio to the region and boosting domestic saving.

Field of Research: Stock Market, Market Efficiency and Behavioral Finance

1. Introduction

There has been considerable research attempting to test efficient market hypothesis (EMH) among stock markets. The efficient market hypothesis is based on the assumption that - at any given time - prices of securities reflect fully all available information about securities. According to this, a stock market is seen as more efficient the faster market relevant information is incorporated into assets prices. Under fully efficient markets, past information should not affect returns in present period Fratzscher (2002). In other words the "efficient stock markets do not allow investors to earn more above-average returns without accepting above-average risks" (Malkiel, 2003, p. 60). However, the main assumption of the efficient market hypothesis is that prices of securities fully reflect all available information about securities. It is believed that this theory is an application of rational expectation to the pricing of securities. An important implication of the efficient market hypothesis is that stock prices should follow a random walk, where the future price changes should be - for all practical purposes - random and therefore unpredictable (Mishkin, 1998, p. 173). A consequence of this is that stock market return can not be predicted from previous price changes.

The random walk hypothesis is associated with the weak form of the efficient market hypothesis. This asserts that all the information contained in the history of yesterday's stock prices are reflected in today's stock prices.

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A very important issue to be highlighted at this stage is that market efficiency does not mean that the market price of a stock should equal the true value of the stock. What it means is that errors in the market price, i.e. over or under valued of the true value, should be unbiased and randomly deviated. Based on this argument, the existence of random deviation prevents investors from finding those over or under valued stocks.

This current study examines the random walk hypothesis in four Middle Eastern stock markets, namely, Egypt, Turkey, Jordan and Morocco. For this purpose the study will apply two approaches. The first approach is the conventional unit root tests of Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests. The second approach is Perron (1997) which tests the unit root hypothesis in the presence of unknown structural break. By implementing these approaches, the random walk hypothesis in these markets could be examined. According to our knowledge no previous study has used unit root tests in the presence of structural change to examine the random walk hypothesis in Middle Eastern stock markets.

The rest of the paper is organized as follows. Section 2 presents the literature review. Section 3 provides an overview of the stock markets in the Middle East. Section 4 presents the methodology using both the conventional unit root tests and the unit root tests in the presence of structural change. Section 5 describes the data used in the study. Section 6 presents the result, while the final section provides conclusion and policy implication.

2. Literature Review

While most of the empirical studies regarding testing the EMH have focused on developed stock markets in different parts of the world, especially US, Europe and Japan, just few studies have focused on the stock markets in the Middle East region. One of the earliest studies that focused on the Middle East was done by done Butler and Malaikah (1992). They examined the behavior of individual stock returns in two stock markets, Saudi Arabia and Kuwait, over the period 1985-1989. They used serial correlation and run several tests to evaluate the weak form of efficiency in these two stock markets. The study tried to investigate the similarities and dissimilarities of these stocks, regarding exchange mechanisms and efficiency. They concluded that institutional factors contribute to operational inefficiency in Saudi Arabia stock market and less pronounced but significant autocorrelations for many Kuwaiti stocks similar to other thinly traded markets.

Another study, by Al-Loughani (1995), used different statistical techniques on the Kuwait market index; it concluded that this index does not follow random walk as it shows signs of stationarity. A recent study by Abraham et al, (2002) tested the random walk hypothesis (RWH) and market efficiency hypothesis for three Gulf countries, namely Saudi Arabia, Kuwait and Bahrain. Their results could not reject the RWH for Saudi and Bahraini markets, while the Kuwaiti market fails to follow a random walk, which means it is inefficient.

There are some pervious studies which used unit root tests in the presence of structural change to examine the random walk hypothesis. Chaudhuri and Wu (2003) implement the Zivot and Andrews (1992) endogenous one break test to examine the random walk hypothesis in seventeen emerging markets. They find that for ten markets, the null hypothesis of a random walk can be rejected at 1% and 5% significance level.

Another study by Narayan and Smyth (2004) implement the same Zivot and Andrews (1992) endogenous one break test and Lumsdaine Papell (1997) two break unit root tests to examine the random walk hypothesis for stock prices in South Korea, their results indicate that stock prices in South Korea are characterized by a unit root, which is consistent with the random walk hypothesis which is considered as an implication of the efficient market hypothesis.

3. An Overview of the Middle Eastern Stock Markets

The financial sector in the Middle East region is dominated by the commercial banks. The non-bank financial sector comprises stock markets, corporate bond market, insurance companies, Pension funds, and mutual funds. The emerging stock markets in Middle East region have achieved considerable improvements in the last decade. Several factors have played vital role in their growth, such as the achievement of higher economic growth, monetary stability, stock markets reforms, privatisation, financial liberalization and institutional framework for investors (Claessens, et al., 2004). These markets are considered relatively small despite the region contains some of the developing world's largest institutional investors in the international bond market (El-Erian and Kumar, 1994, p. 15). Market capitalization in these markets has been boosted by the privatization of public enterprises in most Middle Eastern markets during the 1990's. Despite this development, and in regards to the market indicators, these markets are still far behind developed stock markets and emerging stock markets in South East Asia and Latin America. Table 1 reports the main financial indicators in these markets.

4. Methodology

4. 1. The conventional Augmented Dickey-Fuller (ADF) and Phillips–Perron (PP) unit root tests

To test for the random walk hypothesis in the four emerging stock markets, the study starts with the conventional unit root tests, represented by the Augmented Dickey-Fuller (1979, ADF) and Phillips-Perron (1988, PP) tests.
The ADF tests have the following formulas:

$$\Delta S_t = \alpha_1 + \alpha_2 t + \beta S_{t-1} + \delta \sum_{i=1}^{m} \Delta S_{t-i} + \varepsilon_t \quad (1)$$

$$\Delta S_t = \alpha_1 + \beta S_{t-1} + \delta \sum_{i=1}^{m} \Delta S_{t-i} + \varepsilon_t \quad (2)$$

$$\Delta S_t = \beta S_{t-1} + \delta \sum_{i=1}^{m} \Delta S_{t-i} + \varepsilon_t \quad (3)$$

Table 1. Stock Markets Development Statistics

Market	Market variables	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Egypt	Market Capitalization (US$)	4,263	8,088	14,173	20,830	24,381	32,838	28,741	24,335	26,338	27,847
	Trading Value	757	677	2,463	5,859	5,028	9,038	11,120	3,897	6,443	4,349
	Turnover Ratio (%)	18.7	10.9	22.2	33.5	22.3	31.6	34.7	14.2	24.46	15.62
	Listed Companies	700	746	649	654	861	1,033	1,076	1,110	1150	976
Turkey	Market Capitalization (US$)	21,605	20,772	30,020	61,090	33,646	112,716	69,659	47,150	33,958	68,379
	Trading Value	21,692	51,392	36,831	59,105	68,459	81,277	179,209	77,937	70,667	99,611
	Turnover Ratio (%)	94.2	226.0	133.3	113.5	154.9	102.8	206.2	161.5	170.1	192.4
	Listed Companies	176	205	229	257	277	285	315	310	288	284
Jordan	Market Capitalization (US$)	4,594	4,670	4,551	5,446	5,838	5,827	4,943	6,316	7,087	10,962
	Trading Value	626	517	297	501	653	548	416	933	1,335	2,607
	Turnover Ratio (%)	13.0	11.1	6.4	10.0	11.6	9.4	7.7	16.6	18.83	23.78
	Listed Companies	95	97	98	139	150	152	163	161	158	161
Morocco	Market Capitalization (US$)	4,376	5,951	8,705	12,177	15,676	13,695	10,899	9,087	8,564	13,050
	Trading Value	788	2,426	432	1,048	1,390	2,530	1,094	974	1,441	2,444
	Turnover Ratio (%)	22.1	45.9	5.9	10.2	10.1	17.6	9.2	10.0	16.8	18.7
	Listed Companies	51	44	47	49	53	55	53	55	55	52

Source:

1. Standard & Poor's, Emerging Stock Markets Factbook, 2002, New York.
2. Standard & Poor's, Global Stock Markets Factbook, 2005, New York.

where S_t is the natural logarithm of a stock price index at time t. The first model is represented by equation (1), it includes a constant term (α_1) and a trend term ($\alpha_2 t$) together with am mth order autoregressive term. The second model is represented by equation (2), it includes just a constant term only, and the third model which is represented by equation (3) does not include intercept and trend terms. The null hypothesis of stationarity for all specifications is $\beta = 0$. The autoregressive term ($\delta \sum_{i=1}^{m} \Delta S_{t-i}$) is included to ensure the residual (ε_t) is serially uncorrelated. The PP test introduces a non parametric method to overcome the problem of serial correlation in the error term. In most cases the PP tests gives similar results as the ADF test and suffers from most of the same important limitations. The main equation for PP has the following specification:

$$\Delta s_t = \alpha + \rho s_{t-1} + u_t \qquad (4)$$

Equation (4) is estimated by using the ordinary least square (OLS) method.

4. 2. Testing for a unit root in the presence of structural

Perron (1989) argued that the conventional ADF and PP unit root tests are biased towards the non-rejection of the unit root hull hypothesis in the presence of structural breaks. These tests lack power in the presence of structural breaks in the series and they may fail to show whether a series is first difference stationary (Wilson, et. al. 2003, p. 445). Perron (1989) perceived this phenomenon and proposes a unit root test that allows for a structural change at a known date by incorporating dummy variables for the structural change into the Augmented Dickey-Fuller (ADF) test. Subsequently a significant amount of research which followed Perron (1989) suggests it is better to consider a structural change at an unknown date in which the choice of the break point is considered as endogenous (see Zivot and Andrews (1992), Banerjee, Lumsdaine and Stock (1992), Perron and Vogelsang (1992) and Perron (1997)). This approach is preferred because any arbitrary fixed date can be subject to criticism of data mining (Lai, 2004).

The current study uses Perron's (1997) procedure as it is the most inclusive one amongst all previous studies. Perron's (1997) statistical procedure includes both Innovational Outlier models, namely IO1 and IO2 and the Additive Outlier model (AO). These models test for a unit root allowing for the presence of structural change in the trend function occurred at most once. These tests are considered as more robust and powerful than previous conventional unit root tests.
In the case of applying the IO models this change is assumed to occur gradually by including dummy variables for the structural change into the Augmented Dickey-Fuller test. In the case of applying the AO model, the change is assumed to occur instantaneously.

IO2 model is the most inclusive model, which allows for the occurrence of both changes in the intercept and in the slope of the trend function. It is performed using the *t*-statistic for the null hypothesis that $\alpha = 1$. It takes the following formula:

$$s_t = \mu + \beta_t + \theta DU_t + \gamma DT_t + \delta DT_b + \alpha s_{t-1} + \sum_{i=1}^{k} c_i \Delta s_{t-1} + e_t \qquad (5)$$

where DT_t = 1(t) if $t > T_b$, 0 otherwise.

IO1 model allows for the occurrence of gradual change in the intercept of the trend function. It takes the following formula:

$$s_t = \mu + \beta_t + \theta DU_t + \delta DT_b + \alpha s_{t-1} + \sum_{i=1}^{k} c_i \Delta s_{t-1} + e_t \qquad (6)$$

where $DU_t = 1$ if $t > T_b$, 0 otherwise.
$DT_b = 1$ if $t = T_b + 1$, 0 otherwise.

Model (3) is an Additive Outlier model (AO) that allows for a sudden and rapid change to the trend function. This model uses a two-step procedure. First, the series is de-trended as follows:

$$s_t = \mu + \beta t + \gamma DT_t^* + \tilde{s}_t \qquad (7)$$

where $DT_t^* = 1(t - T_b)$ if $t > T_b$, 0 otherwise.
The test is then performed using the *t*-statistic for $\alpha = 1$ in the regression:

$$\tilde{s}_t = \alpha\tilde{s}_{t-1} + \sum_{i=1}^{k} c_i \Delta\tilde{s}_{t-i} + e_t \qquad (8)$$

The selection of the order of lag employs the "general-to-specific" procedure based on the significant *t*-statistic of the coefficient associated with the last included lag in the estimated regression. In other words, we test the significance of the maximum order lag and start reducing the order until the last lag becomes significant. The selected lag is denoted k and according to some studies, the maximum order of the lag is set at 8 (Ben-David and Papell, 1997). A two-sided 10% test based on the asymptotic normal distribution, which is equal to (1.6), is used to assess the significant of the last lags (Perron, 1997).

To determine the time of the break point endogenously at an unknown break point, the time of the break T_b is selected as the value that minimizes the *t*-statistic for testing $\alpha = 1$. The reason for this is to make it more likely to reject the null hypothesis of $\alpha = 1$ (Wilson, 2004, p.16). In this context, Zivot and Andrews (1992) argue to select the break point that gives the least favorable result for the null hypothesis.

5. Data

This study employs monthly stock market indices for four major stock markets in the Middle East region, namely Egypt, Turkey, Jordan, and Morocco. The data are obtained from Morgan Stanley Capital International (MSCI) (http://www.msci.com). It covers the period from December 1994 to June 2004, for a total of 115 monthly observations for each index included in the study. The stock price indices are expressed in local currencies. This study uses stock prices indices on a monthly basis to avoid distortions common in weekly and daily data arising from non-trading and non-synchronous trading (Hung and Cheung, 1995).

6. Empirical Results

The results for the ADF and PP which are reported in table 2 fail to reject the null hypothesis of a unit root for all monthly stock price indices (in levels). The *t*-statistics obtained for the levels stock indices are less than the critical values in absolute values. This indicates that all indices are non-stationary. The same tests are applied to the first differences of the indices. The results reported in table 3 reject the null hypothesis of non-stationarity for all indices. The *t*-statistics are grater than the critical values in absolute values This means that all indices become stationary if they differenced once and they therefore follow unit root process, meaning they are integrated of order one I(1), which is consistent with the weak form of the efficient market hypothesis.

Table 2. Estimated Results of ADF and (PP) Unit Root Tests.

Variables in levels	ADF Test Statistics			PP Test Statistics		
	Test Statistics	5% C.V.	Lag order	Test Statistics	5% C.V.	Lag order
LE	-2.145	-2.888	4	0.756	-1.944	6
LT	-2.011	-2.887	0	-2.009	-2.887	3
LJ	-0.376	-3.45	1	-0.21	-3.449	4
LM	-1.656	-3.449	0	-1.663	-3.449	4

LE = log (Egypt), LT = log (Turkey), LJ = log (Jordan), LM = log (Morocco).

Table 3. Estimated Results of ADF and (PP) Unit Root Tests.

Variables in first differences	ADF Test Statistics (using local currency)			PP Test Statistics (using local currency)		
	Test Statistics	5% C.V.	Lag order	Test Statistics	5% C.V.	Lag order
ΔLE	-8.622	-1.944	0	-8.972	-1.944	6
ΔLT	-10.601	-2.887	0	-10.603	-2.887	3
ΔLJ	-8.788	-3.45	0	-8.73	-3.45	3
ΔLM	-9.289	-3.45	0	-9.376	-3.45	3

The results of the estimated Perron (1997) IO2 model indicate that all variables show evidence of non stationarity, as the values of $t_{\hat{\alpha}}$ for all variables are less than the critical values (see table 4). However, as the $t_{\hat{\gamma}}$ for the indices of Egypt and Morocco are not significant, the IO1 model (equation 6) is estimated for these two indices in particular. The results in table 5 show that all variables show evidence of unit root. These results confirm the previous results of ADF and PP. In regards to the time of the break in each stock market, it is found that these times are as follow: The time of the break for Egypt is April 2001, for Turkey is July 1999, for Jordan is December 2001 and for Morocco is November 1996. All of these breaks are found to be coincided with observed real events in each market. In order to allow for a sudden and rapid change to the trend function, the AO model is applied and the results that are reported in Table 6. The statistics indicate that all variables show evidence of unit root and the coefficients for all dummy variables are significant.

The possible causes for structural changes in these markets are analysed as follow: In the case of the Egyptian stock market, it witnessed a sharp drop in all market indicators in the year 2000. Many factors caused this abysmal performance. The Egyptian economy was under enormous pressure during 2000 and 2001 because of a sharp drop in oil prices, a sharp decrease in tourism revenue after Luxor events, and the continuing violence and political crisis in the Middle East. By January 2001, the Egyptian Pound was devalued by 9.6%. After that the central bank adopted more flexible exchange rate policy; it again devaluated the Pound by 6.4% in August 2001. All of these events had a negative impact on the Egyptian Stock Market indicators.

Table 4. Empirical Results, Perron's (1997), Model (IO2).

Series: monthly stock price index	Time of the break (T_b)	k	β	t_β	θ	t_θ	γ	$t_{\hat{\gamma}}$	α	$t_{\hat{\alpha}}$	Inference*
Egypt	1996: 7	11	0.015	1.184	0.319	1.458	-0.016	-1.202	0.872	-3.074	Unit root
Turkey	1999: 7	10	0.021	4.223	1.179	4.255	-0.018	-4.146	0.653	-4.671	Unit root
Jordan	2001: 12	12	-0.003	-4.156	-1.058	-4.672	0.012	4.731	0.473	-4.581	Unit root
Morocco	1996: 11	9	-0.000	0.313	0.091	1.376	-0.002	-0.521	0.903	-3.487	Unit root

* The results are significant at 5%. The Critical value = -5.57

Table 5. Empirical Results, Perron's (1997), Model (IO1).

Series: monthly stock price index	Time of the break (T_b)	k	β	t_β	θ	$t_{\hat{\theta}}$	$\hat{\alpha}$	$t_{\hat{\alpha}}$	Inference*
Egypt	2001: 4	11	0.001	1.684	-0.083	-1.789	0.838	-3.205	Unit root
Turkey	2001: 12	10	0.009	3.022	-0.258	-2.772	0.811	-3.307	Unit root
Jordan	2003: 2	12	-0.000	-1.787	0.081	3.347	0.845	-2.850	Unit root
Morocco	1996: 11	9	-0.000	-2.630	0.059	2.355	0.907	-3.525	Unit root

* The results are significant at 5%. The critical values are -5.57 and -5.08 at 1% and 5% levels, respectively.

Table 6. Empirical Results, Perron's (1997), Model (AO).

Series: monthly stock price index	Time of the break (T_b)	k	β	t_β	$\hat{\gamma}$	$t_{\hat{\gamma}}$	$\hat{\alpha}$	$t_{\hat{\alpha}}$	Inference
Egypt	1995: 7	11	0.063	2.108	-0.062	-2.050	0.893	-3.055	Unit root
Turkey	2000: 3	12	0.060	39.619	-0.054	-17.562	0.544	-4.241	Unit root
Jordan	2001: 9	12	-0.006	-19.473	0.028	23.638	0.513	-5.112	Unit root
Morocco	1996: 4	9	0.061	8.535	-0.062	-8.289	0.941	-2.921	Unit root

* The results are significant at 5%. The critical values are -5.41 and -4.80 at 1% and 5% levels, respectively.

The equity market in Turkey (ISE) has been affected by both of the Asian financial crisis in 1997 and the Russian crisis in 1998. Both crises had negative impacts on the Turkish economy as a whole and on the financial sector in particular. As a result of this uncertainty, investors in 2000 transferred around $7 billion out of the economy and between January and August 2000 the ISE index had crashed by 19%. In the year 2001 all market indicators had declined significantly, the market capitalization fell to $47,150 million compared with $69,659 million in 2000.

The stock market in Jordan has been affected by the limits to investor confidence and political developments in the region especially the Palestinian “Intifada”, which casts its shadow on the Jordanian market, and the aftermath of the 11th September 2001 attacks.

In the case of Morocco, despite a huge reduction in the trading value during 1996, it is believed that the signing of trade agreement with the European Union in 1996 had pushed for more improvement in the private sector, which was reflected in the stunning performance of the Casablanca stock Exchange at the end of 1996 and during 1997. The stock market in Morocco has witnessed a sharp drop in trading value during 1996, which has a negative impact on the performance of Casablanca Price index.

7. Conclusion

This study examines the efficient market hypothesis in four main stock markets in the Middle East region, namely, Egypt, Turkey, Jordan and Morocco. In order to run this examination, the study utilizes two approaches. Firstly, the conventional unit root test represented by the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Secondly, the Perron’s (1997) Innovatioanl Outlier (IO) model and the Additive Outlier (AO) model. The results overwhelmingly show that stock price indices in Middle Eastern stock markets are characterized by unit root, which is consistent with the weak-form of the efficient market hypothesis that past movements in stocks prices cannot be used to predict future movements in prices.

The presence of random walks in these stock markets has important implications for managerial decisions, especially those pertaining to issuing and repurchasing common stocks. It also plays an important role in attracting foreign equity portfolio especially from developed countries. Moreover, it plays important role in boosting domestic saving for all classes in these countries. The efficiency of these markets improves the pricing and availability of capital. This has important implications for the allocation of capital within an economy and hence overall economic development.

However, for further studies, it is urgent to cover more emerging stock markets in the region such as Dubai Financial Market, Abu Dhabi Security market, Saudi Financial Market, Qatar Stock Market and Kuwait Stock Exchange. Despite these markets have been established recently, their capitalization has grown massively in the last couple of years.

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