IIIS Discussion Paper

No.92/October 2005

Stock Market Predictability in the MENA: Evidence from New Variance Ratio Tests and Technical Trade Analysis

Thomas Lagoarde Segot
Institute for International Integration Studies
Trinity College Dublin

Brian M Lucey
School of Business
Institute for International Integration Studies
Trinity College Dublin.

IIIS Discussion Paper No. 92

Stock Market Predictability in the MENA: Evidence from New Variance Ratio Tests and Technical Trade Analysis

Brian M Lucey
Thomas Lagoarde Segot

School of Business Studies and Institute for International Integration
University of Dublin, Trinity College.

Stock Market Predictability in the MENA: Evidence from New Variance Ratio Tests and Technical Trade Analysis

Brian M Lucey & Thomas Lagoarde Segot[1]

JEL Classification: G14, G15, O16
Keywords: Emerging markets, stock market predictability, portfolio analysis.

Abstract

The objective of this paper is to test for predictability in the Middle-Eastern North African (MENA) markets by investigating both the weak-form efficiency hypothesis (WFEMH) and the presence of abnormal returns. Starting with tests for the random-walk hypothesis, we use daily data returns and a battery of econometric tests including unit-root analysis, individual and multiple variance ratio, wild bootstrapping and non-parametric tests based on ranks. Our results suggest that only the region's largest markets, Israel and Turkey, follow a random walk. Turning to technical trade analysis, our results reinforce the hypothesis of stock market predictability. Both variable moving average (VMA) and trade range breaking (TRB) trade rules yield significant abnormal returns. We complete the analysis with profit simulations based on the breakeven costs computation methodology and taking into account local transaction costs. Our findings highlight the presence of significant portfolio investment opportunities in the MENA.

Corresponding Author: Brian M Lucey, School of Business Studies and Institute for International Integration, University of Dublin, Trinity College, Dublin 2, Ireland Email: Blucey@tcd.ie Phone: 353-1-6081552 Thomas Lagoarde- Segot, School of Business Studies and Institute for International Integration, University of Dublin, Trinity College, Dublin 2, Ireland Email: lagoardt@tcd.ie Phone: 353-1-6081552

[1] We thank the Government of Ireland for its support through the Programme for Research In Third Level Institutions

1. Introduction

Obtaining adequate information on the stochastic properties of stock market returns is a requirement for the design of international portfolios. If there is no serial statistical dependence between current and past returns or security prices, investors cannot derive profitable investment strategy based on past trends since price changes obey to a random walk process. On the other hand, if dependence is found, rejection of the weak form efficiency hypothesis (WFEMH) indicates that there exists *potential* for a profitable investment rule.

While conventional wisdom suggests that mature stock markets are generally weak form efficient (see Fama, 1965, 1970 et seq), conclusions for emerging markets are slightly more tentative. In these markets, a number of theoretical arguments support the rejection of the random-walk hypothesis. First, in thinly traded markets, the low level of competition and the subsequent dominance of some players may allow individual traders to set stock prices at levels significantly different from their intrinsic value (Mobarek and Keasey, (2000)). Second, the scarcity and uncertain validity of corporate information, the lack of auditing experience and the weaknesses of regulations and disclosure requirements lead to truncated fundamental information (Blavy (2002)). Third, a number of structural and institutional specificities such as the fragmentation of capital markets and the presence of political and economic uncertainties may also account for departure from efficiency (El-Erian and Kumar (1995)).

However, results from empirical investigation are mixed: while some researchers can not reject the random-walk hypothesis for emerging markets (Dickinson and Muragu (1994), Urrutia (1995), Ojah and Karemera (1999)); others find evidence of non-randomness of stock price behaviour (Harvey (1994), Claessens, Dasgupta and Glen (1995), Poshakwale (1996), Nourredine and Khaba, (1998)).

The objective of this paper is to check for the WFEMH in a set of seven Middle-East and North African (MENA) stock markets: Morocco, Tunisia, Egypt, Jordan, Lebanon, Turkey and Israel. For comparative purposes, we also present results for the EMU, a regional benchmark and the World Index.

Three reasons justify this focus. First, these markets are among the world's oldest (the Cairo Stock Exchange was established in 1888) and have been successfully revitalized during the last decade. This has resulted in growing diversification opportunities for international investors (Lagoarde-Segot and Lucey (2005)). Secondly, this group of countries are following a similar economic trajectory through their integration in the EU's neighbourhood policy (Femise, 2005). Their stock markets have however achieved various degrees of development, as market capitalization ranges from 7% in Lebanon to 67% in Israel. These countries therefore constitute an appropriate sample for comparative analysis in emerging markets. Finally, whereas much academic research has been conducted on the properties of the Asian and Latin American countries (Ojah and Karemera (1999), Cheung, Wong and Ho (1993)) the Northern African stock markets have received very little empirical analysis to date. For instance, Civelek (1991) used daily data for the industrial sector of the Amman Financial Market for the period 1 January 1988-3 March 1989, and found relatively frequent positive dependence based on runs and autocorrelation tests. El-Erian and Kumar (1995) used daily data for the same index for a period beginning in September 1992 and ending in March 1994, and confirm this result. Mecagni and Sourial (1999) used four daily aggregate indices and a GARCH(p,q)-M model on the Egyptian stock market for the period 1997-1997 and find evidence for significant departure from the efficient market hypothesis. More recently, Smith (2004) used a variance ratio methodology for Israel, Jordan and Lebanon and finds support for the random walk hypothesis. To our knowledge, there is no comprehensive comparative study of the weak-form efficiency hypothesis for the MENA markets.

Standard empirical testing of the WFEMH can be divided into two sub approaches: one is to determine the existence of predictability using past return series or price information, and the other is to check whether technical trading rules can be exploited as a profit making strategy. Our study encompasses both methodologies. In order to examine the random-walk properties in the studied markets, we use a battery of econometric tests that encompasses unit-root analysis, the heteroscedasticity robust Lo&McKinlay (1988) variance ratio framework, the non-parametric Chow&Denning multiple variance ratio, a wild bootstrap version of the latter, and the Wright (2000) non-parametric rank-based methodology. Turning to the technical analysis, we use the variable moving average (VMA) rules proposed by Brock et al. (1992), as well as trading range break levels (TRB), and we simulate profits based on the method of computation of breakeven transaction costs (Bessembinder and Chan (1995). For comparative purposes, we also present results for the EMU, a regional benchmark and the World Index.

The remainder of the paper is structured as follows. Section 2 presents the MENA markets, data and the methodology. Section 3 presents the results and their interpretation. Section 4 draws together our conclusions.

2. The MENA markets, Data and Methodology

2.1 The MENA markets

Although finance has a long history in the MENA, stock markets were left dormant during much of the twentieth century, as a consequence of economic policy choices and local political conditions. However, a growing awareness of the disadvantages of 'financial repression' led the MENA countries to revitalize their stock markets. The financial reforms were part of a more general transition agenda and were encouraged at the multilateral (World Bank and IMF), regional (Arab Monetary Fund) and intergovernmental levels (the so-called Euro-Mediterranean

Partnership, or Barcelona Process). Overall, the pace of changes has been rather gradual, and capital markets in the region are still dominated by bank assets, which account for about 85% of the region's market structure (IMF, 2004). Nonetheless, as shown underneath, both market capitalisation, the number of listed companies and value traded have significantly increased in most countries over the last decade.

Table 1 Stock Market Development in the MENA

	Market Capitalisation/GDP			Listed Companies			Value traded			Market Liquidity		
Country	**1994**	**2003**	**% change**	**1994**	**2003**	**% change**	**1994**	**2003**	**% change**	**1994**	**2003**	**% change**
EGYPT	0.08	0.34	*336.28*	700	967	*38.14*	355.87	4349.12	*1122.11*	0.08	0.16	*86.89*
MOROCCO	0.16	0.29	*86.71*	61	52	*-14.75*	214.14	2443.46	*1041.06*	0.05	0.19	*288.75*
TUNISIA	0.11	0.10	*-8.60*	21	45	*114.29*	334.48	188.52	*-43.64*	0.13	0.08	*-40.87*
JORDAN	0.76	1.11	*46.49*	95	161	*69.47*	615.81	2607.14	*323.37*	0.13	0.24	*78.67*
Source: World Bank & Arab Monetary Fund (2004)												
LEBANON	0	0.08	-	0	14	-	0	130.99	-	0	0.09	-
ISRAEL	0.56	0.67	*19.51*	638	577	*-9.56*	25136.00	19114.80	*-23.95*	0.81	0.28	*-65.64*
TURKEY	0.49	0.29	*-40.85*	176	285	*61.93*	21667	98160.3	*353.04*	1.00	1.43	*43.14*

Taking these indicators altogether, Israel and Turkey display the highest figures on average. Turkey is by far the most liquid market in the region, while Israel performs well in all four criteria. According to the S&P database, capitalisation and turnover in Israel and Turkey are above the median for the world equity markets. Moreover, these two markets are also the most technologically advanced in the region. Their regional prevalence is therefore not surprising. The emergence of Egypt is a concurrently striking fact, as the percentage change of market capitalization, value traded, as well as the number of firms listed in the stock market is the highest of the sample. Jordan has the highest market capitalisation to GDP ratio, in spite of a relatively small number of firms listed. A robust market expansion can also be found in the case of Morocco, and Lebanon. Results are mixed in the case of Tunisia, where a significant rise in the number of firm listed is counterbalanced by a decrease in the other indicators.

2.2 Data

We use daily data ranging from 1/1/1998 until 11/16/2004, and our sample includes stock market price indexes from Morocco, Tunisia, Egypt, Lebanon, Jordan, Turkey, Israel. Where available, we use the S&P index in order to get a homogenized set of indices. However, the latter is unavailable for Tunisia and Lebanon. For these two countries, we therefore use the national indices, ie the Tunis BVM and the Beirut BLOM, respectively. Tests are computed both in dollar and in national currencies. For comparative purposes, we also present the results for the S&P MENA index (which includes the GCC countries), the S&P Europe index, and for the MSCI World Free Index, which also proxies for the US market. Information on local trading costs was found on the stock market's respective web sites.

3.2 Methodology

Our empirical testing of the WFEMH seeks to determine the existence of predictability using past return series or price information. First, we investigate the existence of predictability using past price information. We then apply technical trading rules to check if they can be exploited as profit making strategies.

3.2.1 Market predictability analysis

The presence of a unit root in the time-series supports the random walk hypothesis, implying market efficiency. The most common framework for such an investigation relies on Dickey-Fuller (1979,1981) methodology. However, according to C.I Lee and al. (2000), the way the null hypothesis for the ADF test is tested is not very informative regarding the presence of a unit root, and the test is not very powerful against relevant alternative hypotheses. We therefore carry the unit-root analysis with the KPSS procedure of Kwiatkowski et al. (1992), which has the

advantage of being specifically designed to test the null hypothesis of stationarity and a unit root as the alternative hypothesis.

The test statistic is calculated as:

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

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

$$S^2(L) = T^{-1} \sum_{t=1}^{T} e_t^2 + 2T^{-1} \sum_{S=1}^{L} (1-S) \Big/ (L+1) \sum_{t=s+1}^{T} e_t e_{t-s} \qquad 2.$$

The null hypothesis of stationarity is rejected in favour of the unit root alternative if the calculated statistic exceeds the critical values exceeded in Kwiatkowski et.al (1992).

However, studies (e.g., Liu and He, 1991) have shown that unit root tests do not uniformly detect departures from a random walk, and are consequently insufficient in testing of the WFEMH. The variance ratio test, as popularized by Lo and MacKinlay (1988) and Cochrance (1988), has often been used as an alternative to examine the predictability of equity returns. This method has the advantage of having good finite-sample properties (Lo and Mac Kinlay, 1989) and of being sensitive to serial correlation. The variance ratio test is based on the idea that if the logarithm of a stock price follows a random walk, then the variance of the return over k period must be equal to $k\sigma^2$. The variance ratio of q-differenced series is given by:

$$VR(q) = \frac{\sum \sigma^2{}_c(q)}{\sum \sigma^2{}_a(q)} \quad 3.$$

where the numerator is an unbiased estimator of 1/q of the variance of the qth differenced series and the denominator is an unbiased estimator of the first-differenced series. The standard test statistic is:

$$Z(q) = \frac{VR(q) - 1}{[\theta\theta(q)]^{1/2}} \quad 4.$$

with $\theta(q) = \frac{[2(2q-1)(q-1)]}{[3q(nq)]}$

A refined test statistic, Z*(q), which adjusts for heteroscedasticity, is proposed by Lo and McKinlay (1989):

$$Z^*(q) = \frac{VR(q) - 1}{[\varphi^*(q)]^{1/2}} \quad 5.$$

where

$$\varphi^*(q) = \sum_{j=1}^{q-1} \left[\frac{2(q-j)}{q} \right] \delta(j) \quad 6.$$

and

$$\delta(j) = \frac{\sum_{t=j+2}^{nq+1} (p_t - p_{t-1} - \mu)^2 (p_{t-j} - p_{t-j-1} - \mu)^2}{\left[\sum_{t=2}^{nq+1} (p_t - p_{t-1} - \mu)^2 \right]^2} \quad 7.$$

Both Z(q) and Z*(q) are asymptotically distributed with mean zero and unit standard deviation. However, one limit to this approach is that it tests whether the variance ratio is equal to one for a particular holding period, whereas the random walk hypothesis requires that the variance ratios for all aggregation intervals selected should be equal to one. As an alternative to individual variance ratio tests, Chow and Denning's (1993) have proposed a multiple variance ratio test, where a set of variance ratios is tested against one. Under the null hypothesis, V (qi) = 1 for i = 1,…,l against the alternative hypothesis that V(qi) ≠ 1 for some i. The test is based on the idea that the decision regarding the null hypothesis can be made according to the maximum absolute value of the individual variance ratio statistics, that is:

$$MV_1 = \max |Z^*(t,k)|$$

The statistic follows the studentized maximum modulus (SMM) distribution with *l* and T degrees of freedom, whose critical values can be calculated based on the limiting distribution of the statistic. At the α level of significance, the null hypothesis is rejected if MV* is greater than the $[1- \alpha^*/2\}^{th}$ percentile of the standard normal distribution, where $\alpha^*=1-(1- \alpha)^{1/l}$. The calculated critical value is 2.79.

However, the inconvenient with sub-sampling methodologies is that they require the choice of block length. The optimal block length is unknown, and the test can yield different inferential outcomes for different choices of block length. Following Jae H.Kim (2005), we therefore apply a wild bootstrap to MV*, which is an asymptotical pivotal statistic under the assumption H* of Lo and MacKinlay (1988). The advantage of bootstrapping asymptotically pivotal statistic is well documented (MacKinnon, 2002). The wild bootstrap test of MV* is conducted in three steps:

1. Form a bootstrap sample of T observations $X^*_t = \eta_t X_t \quad (t = 1,...T)$ where η_t is a random sequence with $E(\eta_t) = 0$ and $E(\eta_t^2) = 1$.
2. Calculate MV_1, which is the Chow-Denning statistic obtained from the bootstrap sample generated in stage 1.
3. Repeat stages 1 and 2 sufficiently many, say m, times to form a bootstrap distribution of the test statistic $\{MV^{*j}\}_{j=1}^{m}$.

The bootstrap distribution $\{MV^{*j}\}_{j=1}^{m}$ is used to approximate the sampling distribution of the MV_1 statistic. The 100α% critical value of the test can be obtained as the (1-α)th percentile of $\{MV^{*j}\}_{j=1}^{m}$, while the p-value of the test is the proportion of $\{MV^{*j}\}_{j=1}^{m}$ greater than the MV_1 statistic calculated from the original data.

Finally, we know that non-parametric test statistics are more powerful in rejecting the random-walk hypothesis in the case of non-normal time series since they allow deriving specific critical values by simulating the exact sampling distribution (Luger, 2000). Considering the skewness of our series, it appears appropriate to complement the analysis with a non-parametric component, which does not appeal to any asymptotic approximation. We use Wright's (2000) variance ratio tests based on ranks. Let $r(y_t)$ be the rank of y_t among $y_1, y_2 ... y_T$. Define:

$$r_{1t} = \left(\mathrm{r}(\mathrm{y}_t) - \frac{T+1}{2} \right) \Big/ \sqrt{\frac{(T-1)(T+1)}{12}} \qquad 8.$$

$$r_{2t} = \phi^{-1} \times r(y_t) \Big/ T+1 \qquad 9.$$

Where ϕ is the standard cumulative distribution function. The series r_{1t} is a linear transformation of the ranks, standardized to have sample mean 0 and sample variance 1. The series r_{2t} has sample mean 0 and sample variance approximately equal to 1.

Wright's tests substitute r_{1t} and r_{2t} in place of y_t in the definition of Lo and MacKinlay tests statistic, which can then be written as:

$$R_1 = \left[\frac{\frac{1}{Tk} \sum_{t=k+1}^{T} (r_{1t} + r_{1t-1} \ldots + r_{1t-k})^2}{\frac{1}{T} \sum_{t=1}^{T} r_{1t}^2} - 1 \right] \times \left[\frac{2(2k-1)(k-1)}{3kT} \right]^{-1/2} \quad 10.$$

And

$$R_2 = \left[\frac{\frac{1}{Tk} \sum_{t=k+1}^{T} (r_{2t} + r_{2t-1} \ldots + r_{2t-k})^2}{\frac{1}{T} \sum_{t=1}^{T} r_{2t}^2} - 1 \right] \times \left[\frac{2(2k-1)(k-1)}{3kT} \right]^{-1/2} \quad 11.$$

Under the hypothesis that y_t is independently and identically distributed, $r(y_t)$ is a random permutation of the numbers 1,2…T, each with equal probability, giving the distribution of the test statistics. The exact sampling distribution of R_1 and $R2$ can therefore be simulated to an arbitrary degree of accuracy, for given choices of T and k. Critical values are given in annex. For further methodological details see Wright (2000).

3.2.2 Technical Trading Rules

The VMA rule states that one should take a long position if the short-term VMA is above the long-term VMA and stay short otherwise.

$$I_t = \begin{cases} 1 \quad if \quad \frac{1}{S}\sum_{s=1}^{S} P_{t-s} \geq \frac{1}{L}\sum_{l=1}^{L} P_{t-l} \\ 0 \quad otherwise \end{cases} \qquad 12.$$

where S and L stand for short and long-term, respectively. Following Brock at al. (1992) and most of the literature on technical analysis, we select 1_50, 1_150, 5_150, 1_200 and 2_200 as VMA rules, where 1, 2 and 5 represent the number of days in the short-term moving average and 50, 150 and 200 the number of days in the long-term moving average.

The other technical rule that is used in this paper is a TRB trading rule. One receives a buy signal if prices penetrate the resistance level, i.e., go above a local maximum and a sell signal is given if prices fall below a local minimum (support level). If prices remain in the intermediate range then one maintains the original position. This rule can be defined as:

$$I_t = \begin{cases} 1 \quad if \quad P_{t-1} = Max[P_{t-1}, P_{t-2}, ..., P_{t-h}] \\ 0 \quad if \quad P_{t-1} = Min[P_{t-1}, P_{t-2}, ..., P_{t-h}] \\ I_{t-1} \quad if \quad P_{t-1} \in \left(Min[P_{t-1}, P_{t-2}, ..., P_{t-h}], Max[P_{t-1}, P_{t-2}, P_{t-h}]\right) \end{cases} \qquad 13.$$

where *H* stands for the number of days that is used in the TRB trading rule. The return for these strategies can be given by:

$$\mu_{t+1} = I_t\left(\frac{P_{t+1}}{P_t} - 1\right) - I_{t-1}(I_t - 1)\left(\frac{P_{t+1}}{P_t} - 1\right) \qquad 14.$$

The first null hypothesis we test is that the returns generated by technical trading rules are zero. The student test statistic is calculated as $T = \frac{\sqrt{N}\overline{R}}{\sigma_R}$, where $\overline{R}$ denotes the average daily returns, σ_R is the standard deviation of daily returns and N is the number of daily observations. The second null hypothesis we test is that the mean returns generated by technical trading rules equals

the returns derived by the buy-and-hold strategy. Following Brock et.al(1992), the t-statistics for the buys, sells and the buy-sell difference are:

$$B = \frac{\mu_b - \mu}{\sqrt{\sigma^2/n + \sigma^2{}_b/n_b}}; S = \frac{\mu_s - \mu}{\sqrt{\sigma^2/n + \sigma^2{}_b/n_s}}; BS = \frac{\mu_b - \mu_s}{\sqrt{\sigma^2/n_b + \sigma^2{}_b/n_s}} \quad (15.)$$

$$\text{with } \mu_{b,s} = \frac{1}{n_{b,s}} \sum_{t=0}^{n+1} R_{t+1} I_t \text{ and } \sigma^2_{b,s} = \frac{1}{n_{b,s}} \sum_{t=0}^{n+1} \left(R_{t+1} - \mu_{b,s}\right)^2 I_t \quad (16.)$$

Finally, we adopt the framework of a 'double or out' strategy in order to simulate the profit from applying trading strategies. Therefore, when a 'buy' signal is generated, the investor will borrow at the risk-free interest rate and double her equity investment in the market. In response to sell signals, the investor will sell the shares and invest in the risk free interest rate. We assume that the borrowing and lending rates are the same and that the risk during buys and sells periods are the same. We use the average yield of the 3-months US Treasury bill as proxy for the risk-free interest rate. In order to take into account the presence of local trading costs, we adopt the method of computation of breakeven transaction costs as developed by Bessembinder and Chan (1995), in which net profit can be expressed as $\pi_n = \pi_r C * \left(N_b + N_s\right)$, where π_r is the raw profit, C is the percentage round-trip transaction costs and N_b and N_s are the number of buy and sell signals in a year.

4. Results and Analysis

4.1 Variance Ratio Tests

Our main finding is that the number of weak form efficient markets seems to diminish with the power of the econometric methodology: beginning with the KPSS unit root analysis, we find that the null hypothesis of stationarity is significantly rejected for all markets, providing preliminary support for the efficiency hypothesis.

Table 2 KPSS Unit Root Tests

In US dollars							
Lags Number	Egypt	Jordan	Turkey	Lebanon	Israel	Morocco	Tunisia
L=0	120,64**	94,80**	34,38**	125,77**	40,36**	96,87**	57,18**
L=9	12,16**	9,61**	3,48**	12,70**	4,08**	9,73**	5,76**
L=29	4,12**	3,29**	1,19**	4,31**	1,39**	3,28**	1,95**
In National Currencies							
Lags Number	Egypt	Jordan	Turkey	Lebanon	Israel	Morocco	Tunisia
L=0	41,76**	94,26**	102,45**	124,99**	82,52**	66,16**	58,76**
L=9	4,24**	9,55**	10,38**	12,62**	8,33**	6,64**	5,91**
L=29	1,46**	3,27**	3,56**	4,28**	2,84**	2,23**	1,99**

.

Then, turning to the Lo & MacKinlay variance ratio analysis, and using the data in dollars, the random walk hypothesis is rejected only for Egypt and Morocco. When taking the series in dollars, the WFEMH is also rejected for Egypt, Morocco, and Lebanon. Egypt's stock market has known a dramatic expansion over the last decade, but was very small in terms of market capitalization and liquidity and the beginning of the study period. This can furnish a theoretical ground to the rejection of the efficiency hypothesis. In the case of Morocco, the same factors, plus the low number of firms on the market, can explain weak-form inefficiency. The rejection of the efficient market hypothesis in the case of Lebanon can also be explained in terms of small capitalization, liquidity and number of stocks. The 15% price limit regulation operating in Beirut can also constrains efficiency in the stock market (Ryoo and Smith, 2002). The Chow & Denning multiple variance ratio tests and their bootstrap version confirm the latter result, both in local currencies and in dollars.

Table 3 Individual Variance Ratio Tests

	In local currency		In dollars			In local currency		In dollars	
Egypt					**Israel**				
k	Z	Z*	Z	Z*	k	Z	Z*	Z	Z*
2	3,44	2.42**	2,56	1,73	2	1,19	1,16	1,39	1,4
5	5,41	3.81**	4,7	3.09**	5	1,61	1,33	1,78	1,56
10	5,21	3.61**	4,28	2.73**	10	0,83	0,68	0,75	0,64
30	5,29	3.84**	4,17	2.74**	30	1,62	1,34	1,4	1,22
Morocco					**Tunisia**				
k					k				
2	7,35	4.6**	11,79	5.23**	2	-0,3	-0,06	-0,36	-0,06
5	6,39	4.31**	10,69	5.45**	5	-1,14	-0,29	-1,72	-0,36
10	5,72	4.21**	9,02	5.28**	10	-1,39	-0,44	-1,85	-0,49
30	5,09	4.25**	6,57	4.77**	30	0,44	0,2	-0,27	-0,11
Jordan					**Turkey**				
k					k				
2	0,58	0,26	0,41	0,19	2	-0,33	-0,17	-0,77	-0,53
5	0,78	0,41	0,75	0,4	5	0,03	0,02	-0,54	-0,39
10	0,85	0,51	0,83	0,49	10	-0,47	-0,27	-0,9	-0,65
30	1,59	1,06	1,59	1,07	30	0,95	0,54	0,48	0,35
Lebanon					**MENA**				
k					k				
2	6,87	4.12**	-2,06	-1,61	2	5,43	4.16**	5,43	4.16**
5	6,86	4.56**	-1,08	-0,87	5	5,21	4.02**	5,21	4.02**
10	5,41	3.89**	-0,65	-0,54	10	4,8	3.78**	4,8	3.78**
30	3,28	2.61**	-0,3	-0,27	30	4,93	3.98**	4,93	3.98**

One star indicates rejection of the random-walk hypothesis at the 5% level, and two stars indicates rejection of the random walk hypothesis at the 1% level. For the MENA benchmarks we report results in the international currency (US dollars) in both columns.

Table 4 Multiple variance ratio tests

	In dollars		In local currencies	
	MV1	MV1*	MV1	MV1*
Egypt	2.95**	0.007**	4.07**	0**
Israel	1.77	0.19	1.41	0.36
Jordan	1.05	0.61	1.04	0.56
Morocco	5.91**	0.00**	4.72**	0**
Tunisia	0.82	0.81	1.03	0.56
Lebanon	3.24**	0.003**	3.43**	0**
MENA	3.9639**	0.0010**	3.9639**	0.0010**
Turkey	0.689	0.822	0.85	0.82

MV1 is the heteroskedastic-robust version of the Chow-Denning test; MV1* is its bootstrap version. The entries for MV1 test are the test statistics, while those for MV1* are the p-values of the test. One star indicates significance at the 10% level; while two stars significance at the 5% level. The 5% and 10% values for the MV1 test are 2.79 and 2.22, and the k vector = (2,5,10,30).

Finally, Wright's non-parametric analyses highlights that Tunisia and Jordan are also weak form inefficient. Tunisia's stock market has contracted over the study period, while the Amman stock exchange, although large in capitalization, is dominated by a very small number of firms, which might depart prices from a random walk. A the end of the investigation, the WFEMH abides only in Turkey and Israel, which are our sample's most developed markets of the sample. At first glance, this result seems to corroborate the view that the weak-form efficiency hypothesis is more likely to be verified in the largest markets. Nevertheless, one still has to be cautious with this explanation: applying the same battery of tests to the EMU and World benchmarks, the WFEMH is rejected as soon as we skip from the individual variance ratio to the multiple variance ratio analysis. Rather than providing clear-cut evidence that the WFEMH is more likely to occur in the more developed markets, our results therefore seem to suggest that the WFEMH is often rejected as we move towards more refined statistical methodologies, and constitute an incentive to conduct further research in this branch of the literature.

Table 5 Non Parametric variance ratio tests

	In local currency		In dollars			In local currency		In dollars	
Egypt	R1		R1	R2	**Israel**	Z			
k		R2			k		Z*	Z	Z*
2	4.32 **	3.98**	3.05 **	2.88 **	2	1.58	1.62	1.92 **	1.65
5	6.73 **	6.37**	6.06 **	5.83**	5	1.85	1.89	2.28 **	1.92
10	7.06 **	6.51**	6.72**	6.11 **	10	0.95	0.81	1.28	0.94
30	8.18 **	7.26 **	7.58 **	6.57**	30	1.32	1.31	1.69	1.58
Morocco					**Tunisia**				
k					k				
2	6.93 **	7.62**	12.70 **	13.23 **	2	10.84	11.98**	8.34 **	9.18**
5	7.58 **	7.41**	15.09**	14.46**	5	10.32	9.81**	7.40 **	7.28**
10	7.14 **	6.82**	14.63 **	13.39**	10	9.07	8.08**	5.94 **	5.47**
30	6.84 **	6.29**	12.30 **	10.83**	30	9.6	8.38**	6.68 **	6.06 **
Jordan					**Turkey**				
k	4.23 **	3.53**	3.63 **	3.04**	**k**	-0.41	-0.57	0.82	0.42
2					2				
5	4.23 **	3.43**	4.14 **	3.37 **	5	-0.34	-0.38	0.27	0.5
10	3.85 **	3.13 **	3.78 **	3.07 **	10	-0.39	-0.64	0.04	-0.06
30	2.78 **	2.46**	2.53 **	2.28 **	30	-0.03	0.14	0.67	0.8
Lebanon					**MENA**				
k	4.42 **	5.51**	-2.57	-2.29	**k**	5.44 **	5.51 **	5.44 **	5.51 **
2					2				
5	6.89**	7.35**	-0.84**	-0.93*	5	5.28 **	5.15 **	5.28 **	5.15 **
10	6.32 **	6.46**	-0.03 **	-0.32**	10	4.43**	4.53**	4.43**	4.53**
30	4.17 **	4.29**	0.38 **	0.16**	30	4.30 **	4.35**	4.30 **	4.35**

One star indicates rejection of the random-walk hypothesis at the 5% level, and two stars indicates rejection of the random walk hypothesis at the 1% level. For the MENA benchmarks we report results in the international currency (US dollars) in both columns.

Table 6 Benchmark variance ratio tests

Individual VR Tests	EMU		World	
K	Z	Z*	Z	Z*
2	3,34	2.56*	7,21	6.36**
5	2,19	1,66	4,14	3.51**
10	1,18	0,9	1,93	1,65
30	2,12	1,69	0,96	0,83
Non Parametric VR tests				
K	R1	R2	R1	R2
2	3.41 **	3.55**	7.57 **	7.35 **
5	2.36 **	2.39***	4.24 **	4.13**
10	1.35 **	1.28**	2.14 **	1.9
30	1.84 **	2.06**	1.78	1.11
Multiple VR Tests				
MV1	2.5592		5.3513**	
MV1*	0.0240 **		0.0000**	

For the individual and non parametric VR tests, one star indicates rejection of the random-walk hypothesis at the 5% level, and two stars indicates rejection of the random walk hypothesis at the 1% level. For the MENA benchmarks we report results in the international currency (US dollars) in both columns. MV1 is the heteroskedastic-robust version of the Chow-Denning test; MV1* is its bootstrap version. The entries for MV1 test are the teststatistics, while those for MV1* are the p-values of the test. One star indicates significance at the 10% level; while two stars significance at the 5% level. The 5% and 10% values for the MV1 test are 2.79 and 2.22, and the k vector = (2,5,10,30).

4.2 Technical Trading Rules

Results from the technical trade analysis overall confirm the hypothesis of market predictability. First, all the daily one-day average returns for buy signals are positive. Second, our t statistics significantly reject both the null of zero returns following a technical analysis, and the null of equal returns with the buy and hold strategy. Finally, our profit simulations suggest that technical trade rules applied to these markets can yield significant abnormal positive returns. Regarding the VMA strategy, these returns seem possible in Jordan, Tunisia, Turkey and Israel. The TRB performs better, as extra profits can be expected in all countries but Lebanon. Besides, profit estimations in these countries are comparable to those obtained for the EMU, MENA and World

benchmarks. Our investigation therefore clearly highlights the potential of the Mediterranean markets in the international investor's portfolio diversification strategies.

Conclusion

The objective of this paper is to test for predictability in seven Middle-Eastern markets by investigating both the weak-form efficiency hypothesis (WFEMH) and the returns from technical analysis. Starting with tests for the random-walk hypothesis, we used daily data returns and a battery of econometric tests including unit-root analysis, individual and multiple variance ratio, wild bootstrapping and non-parametric tests based on ranks. Our results suggested that only the most developed markets - Israel and Turkey – seem to follow a random walk. Turning to technical analysis, the implementation of variable moving average (VMA) and trade range breaking (TRB) trade rules constituted further evidence for stock market predictability. Finally, taking into account local trading costs, profit simulations based on the breakeven costs computation methodology confirmed the possibility of raising abnormal positive returns in the region. This study therefore highlighted the presence of significant portfolio investment opportunities in the MENA.

Annex 1: VMA analysis

Egypt	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	868	877	0.0256	-0.0388	0.0644	3.1370	4.8953	-1.7583	-2.3815
			1.7864*	-2.7685**	2.2402**				
			1.3480	-1.2589					
(1,150)	855	790	0.0417	-0.0515	0.0933	5.0636	5.8502	-0.7865	-1.3740
			2.9574**	-3.5112**	3.0960**				
			2.0061*	-1.6621*					
(5,150)	854	791	0.0461	-0.0562	0.1023	5.5947	6.3813	-0.7865	-1.3740
			3.2126**	-3.9019**	3.4031**				
			2.1568*	-1.8653*					
(1,200)	823	772	0.0478	-0.0535	0.1013	5.5829	5.9347	-0.3518	-0.9214
			3.3829**	-3.5935**	3.2852**				
			2.2194*	-1.7053*					
(2,200)	831	764	0.0619	-0.0699	0.1317	7.3093	7.6611	-0.3518	-0.9214
			4.2620**	-4.8493**	4.2902**				
			2.7367**	-2.3652**					

Israel	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	884	861	0.0672	-0.0465	0.1137	8.4524	5.7544	2.6979	2.6979
			5.0831**	-2.8769**	3.7907**				
			2.3726**	-2.0511*					
(1,150)	858	788	0.0590	-0.0430	0.1021	7.2036	4.8791	2.3244	2.3244
			4.3890**	-2.6114**	3.2323**				
			1.9922*	-1.8390*					
(5,150)	852	793	0.0254	-0.0063	0.0317	3.0582	0.7499	2.3083	2.3083
			1.8709*	-0.3846	1.0029				
			0.6135	-0.5744					
(1,200)	833	762	0.0660	-0.0338	0.0997	7.8163	3.7093	4.1070	4.1070
			4.9604**	-2.1035*	3.1727**				
			2.2702*	-1.5298					
(2,200)	842	753	0.0442	-0.0106	0.0548	5.2818	1.1748	4.1070	4.1070
			3.4475**	-0.6401	1.7284*				
			1.4196	-0.7050					

Morocco	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	821	924	0.0546	-0.0528	0.1074	6.3682	7.0065	-0.6383	-3.3804
			7.6608**	-7.8337**	7.6077**				
			4.3773**	-4.4611**					
(1,150)	732	913	0.0522	-0.0538	0.1060	5.4304	7.0473	-1.6169	-4.2019
			7.1663**	-7.9109**	7.1288**				
			3.9588**	-4.5012**					
(5,150)	744	901	0.0364	-0.0421	0.0784	3.8323	5.4491	-1.6169	-4.2019
			4.8755**	-6.249**0	5.2347**				
			2.7412**	-3.5162**					
(1,200)	724	871	0.0513	-0.0562	0.1075	5.2726	7.0257	-1.7531	-4.2595
			7.0617**	-8.145**0	7.1044**				
			3.8825**	-4.5883**					
(2,200)	713	882	0.0428	-0.0480	0.0908	4.3278	6.0809	-1.7531	-4.2595
			5.7119**	-7.0968**	5.9297**				
			3.1566**	-3.9794**					

Tunisia	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	847	898	0.0706	-0.0299	0.1005	8.5112	3.8659	4.6454	0.6568
			5.3998**	-2.7177**	4.0890**				
			2.3349**	-2.4470**					
(1,150)	801	844	0.0733	-0.0310	0.1044	8.3559	3.7764	4.5795	0.8195
			5.5870**	-2.6762**	4.0255**				
			2.3999**	-2.3727**					
(5,150)	792	853	0.0432	-0.0020	0.0452	4.8543	0.2748	4.5795	0.8195
			2.9783**	-0.1962	1.7184*				
			1.0073	-1.0630					
(1,200)	763	832	0.0644	-0.0252	0.0896	6.9837	3.0322	3.9515	0.3058
			4.4114**	-2.4531**	3.3182**				
			1.8227*	-2.2495**					
(2,200)	761	834	0.0447	-0.0071	0.0518	4.8312	0.8797	3.9515	0.3058
			3.0564**	-0.6892	1.9136*				
			1.0455	-1.3082					

Jordan	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	839	906	0.0434	-0.0018	0.0453	5.1698	0.2721	4.8977	4.8653
			4.8810**	-0.1973	2.4459**				
			1.4889	-1.3564					
(1,150)	784	861	0.0489	-0.0095	0.0585	5.4481	1.2035	4.2446	4.2141
			5.5742**	-1.0056	3.0678**				
			1.8118*	-1.7900*					
(5,150)	809	836	0.0390	-0.0016	0.0406	4.4704	0.2258	4.2446	4.2141
			4.0441**	-0.1859	2.1176*				
			1.1287	-1.3742					
(1,200)	767	828	0.0492	-0.0052	0.0543	5.3543	0.6448	4.7094	4.6798
			5.6600**	-0.5356	2.7929**				
			1.8256*	-1.4831					
'(2,200)	780	815	0.0455	-0.0026	0.0481	5.0415	0.3321	4.7094	4.6798
			5.2557**	-0.2647	2.4688**				
			1.6120*	-1.3169					

Turkey	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	845	900	0.1244	-0.1180	0.2425	14.9864	15.2088	-0.2225	-0.2275
			3.4207**	-2.9560**	3.1326**				
			1.9547*	-1.6803*					
(1,150)	798	847	0.1009	-0.0952	0.1962	11.4745	11.5541	-0.0796	-0.0843
			2.6871**	-2.3796**	2.4205**				
			1.5321	-1.3158					
(5,150)	837	808	0.0314	-0.0326	0.0640	3.7205	3.8001	-0.0796	-0.6671
			0.8856	-0.7735	0.7852				
			0.5401	-0.3961					
(1,200)	784	811	0.1268	-0.0791	0.2059	14.1706	9.2005	4.9701	4.4004
			3.4344**	-2.0257*	2.5547**				
			1.9227*	-1.0869					
(2,200)	793	802	0.0885	-0.0436	0.1321	9.9968	5.0267	4.9701	4.4004
			2.3762	-1.1216	1.6360				
			1.3547	-0.5762					

Lebanon	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	833	749	-0.0433	0.0230	-0.0663	-5.1860	-2.4253	-2.7607	-2.9415
			-2.6784	1.5585*	-2.0129**				
			-1.0192	1.3676					
(1,150)	907	610	-0.0407	0.0361	-0.0768	-5.3055	-3.1101	-2.1954	-2.3688
			-2.6538**	2.2573	-2.2007*				
			-0.9896	1.6143					
(5,150)	854	688	-0.0346	0.0284	-0.0629	-4.2513	-2.7547	-1.4966	-1.6728
			-2.2969*	1.7554*	-1.8500*				
			-0.7521	1.4201					
(1,200)	894	620	-0.0474	0.0254	-0.0729	-6.0898	-2.2206	-3.8693	-4.0423
			-2.9607**	1.6936*	-2.1315*				
			-1.2023	1.3440					
(2,200)	860	659	-0.0411	0.0157	-0.0568	-5.0853	-1.4417	-3.6436	-3.8172
			-2.6038**	1.0241	-1.6687*				
			-0.9683	1.0248					

MENA	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	923	822	0.0533	-0.0287	0.0819	6.9881	3.4006	3.5875	2.4906
			5.6679**	-2.6691**	3.9801**				
			2.2398*	-2.3636**					
(1,150)	898	747	0.0590	-0.0257	0.0847	7.5414	2.7752	4.7663	3.7323
			6.9558**	-2.3909**	4.1273**				
			2.7279**	-2.1311*					
(5,150)	898	747	0.0496	-0.0144	0.0640	6.3359	1.5697	4.7663	3.7323
			5.6843**	-1.3644	3.1251**				
			2.0972*	-1.5742					
(1,200)	891	704	0.0612	-0.0168	0.0780	7.7588	1.7203	6.0384	5.0359
			7.5730**	-1.7473*	4.0732**				
			2.9395**	-1.7767*					
(2,200)	874	721	0.0667	-0.0216	0.0883	8.2962	2.2578	6.0384	5.0359
			8.3115**	-2.2503*	4.6439**				
			3.2920**	-2.0555*					

EMU	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	899	846	0.0515	-0.0199	0.0714	6.5784	2.4386	4.1398	4.0152
			3.2189**	-1.0041	1.9469*				
			1.2229	-1.0594					
(1,150)	862	783	0.0588	-0.0234	0.0822	7.2125	2.6461	4.5664	4.4489
			3.6377**	-1.1878	2.1727*				
			1.4483	-1.1354					
(5,150)	886	759	0.0546	-0.0210	0.0756	6.8753	2.3088	4.5664	4.4489
			3.4818**	-1.0371	1.9735*				
			1.3406	-1.0328					
(1,200)	838	757	0.0586	0.0107	0.0479	6.9762	-1.1226	8.0987	7.9848
			3.6421**	0.5735	1.2896				
			1.4313	-0.1611					
(2,200)	856	739	0.0585	0.0096	0.0489	7.1182	-0.9806	8.0987	7.9848
			3.7003**	0.5065	1.3076				
			1.4538	-0.1890					

World	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
(1,50)	873	872	0.0435	-0.0397	0.0833	5.3934	4.9838	0.4096	0.2850
			4.6517**	-3.8043**	4.1393**				
			2.3513*	-2.4509**					
(1,150)	824	821	0.0349	-0.0336	0.0684	4.0720	3.9706	0.1014	-0.0161
			3.6489**	-3.1894**	3.2585**				
			1.7735*	-2.0524*					
(5,150)	845	800	0.0172	-0.0167	0.0340	2.0478	1.9464	0.1014	-0.0161
			1.8626*	-1.5390	1.6064				
			0.7731	-1.1032					
(1,200)	812	783	0.0412	-0.0319	0.0732	4.7479	3.6067	1.1412	1.0273
			4.4364**	-3.1005**	3.5112**				
			2.1715*	-1.9610*					
(2,200)	817	778	0.0296	-0.0202	0.0497	3.4169	2.2757	1.1412	1.0273
			3.2218**	-1.9295*	2.3786**				
			1.5012	-1.3073					

Annex 2: TRB analysis

Egypt	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	629	615	-0.037	0.026	-0.063	-3.3737	-2.2503	-1.1233	-1.5676
			-2.727**	1.763*	-1.851*				
			-1.082	1.179					
5	371	373	-0.002	0.021	-0.022	-0.1144	-1.0643	0.9499	0.6842
			-0.116	1.440	-0.517				
			0.201	0.832					
10	187	189	0.044	-0.049	0.093	1.1343	1.3572	-0.2229	-0.3572
			3.540**	-3.531**	1.616				
			1.269	-0.911					
25	81	70	0.057	0.000	0.057	0.6282	0.0294	0.5988	0.5449
			3.937**	0.023	0.516				
			0.934	0.096					
50	42	31	-0.057	0.154	-0.212	-0.3769	-0.6506	0.2737	0.2476
			-3.874**	8.766**	-1.281				
			-0.504	1.205					

Israel	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	588	608	0.0380	-0.0065	0.0445	3.1584	0.5977	2.5607	2.5607
			2.5209**	-0.4789	1.2651				
			0.9173	-0.6059					
5	356	374	0.0509	-0.0624	0.1134	2.5577	3.3686	-0.8108	-0.8108
			3.7948**	-4.8859**	2.7559**				
			1.2106	-2.2931**					
10	183	189	0.0219	-0.0502	0.0721	0.5396	1.3894	-0.8498	-0.8498
			1.8692*	-3.9618**	1.3454				
			0.2944	-1.4468					
25	78	77	-0.0577	-0.0674	0.0097	-0.6759	0.7748	-1.4507	-1.4507
			-4.8310**	-4.7524**	0.1091				
			-1.1481	-1.1082					
50	36	42	-0.0646	-0.1310	0.0665	-0.3654	0.8195	-1.1849	-1.1849
			-4.7816**	-8.0801**	0.4662				
			-0.7754	-1.3198					

Morocco	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	619	625	0.058	-0.042	0.100	5.0717	3.7881	1.2837	-0.7423
			7.608**	-6.747**	5.979**				
			3.980**	-3.272**					
5	388	376	0.081	-0.067	0.147	4.4366	3.6144	0.8222	-0.4221
			9.726**	-10.479**	6.515**				
			4.248**	-4.246**					
10	189	195	0.118	-0.107	0.225	3.1638	3.0089	0.1548	-0.4705
			12.231**	-15.986**	6.244**				
			3.887**	-4.953**					
25	97	83	0.188	-0.166	0.354	2.5757	2.0008	0.5749	0.2818
			16.077**	-19.929**	5.575**				
			3.715**	-4.201**					
50	47	43	0.258	-0.224	0.482	1.6991	1.4068	0.2923	0.1458
			22.494**	-22.665**	5.052**				
			3.632**	-3.477**					

Tunisia	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	619	601	0.065	-0.026	0.091	5.6973	2.2944	3.4029	0.6143
			5.268**	-2.485**	3.275**				
			1.935*	-2.032*					
5	378	379	0.120	-0.038	0.158	6.4448	2.0762	4.3685	2.6383
			8.615**	-3.338**	4.037**				
			3.123**	-2.042*					
10	185	179	0.142	-0.068	0.210	3.7200	1.7722	1.9478	1.1158
			8.065**	-6.716**	3.306**				
			2.207*	-2.516**					
25	76	73	0.155	-0.106	0.261	1.6476	1.1366	0.5110	0.1704
			6.086**	-8.741**	1.896*				
			1.101	-2.025*					
50	43	34	0.084	-0.065	0.149	0.4808	0.3510	0.1298	-0.0462
			2.591**	-5.173**	0.654				
			0.314	-0.902					

Jordan	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	632	627	0.029	0.035	-0.005	2.6291	-3.0947	5.7238	5.7004
			3.001**	3.755**	-0.238				
			0.513	0.832					
5	39	55	0.240	0.146	0.095	1.3043	-1.1102	2.4145	2.4128
			15.227**	9.800**	0.692				
			2.052**	1.473					
10	184	197	0.068	0.016	0.052	1.7463	-0.4191	2.1654	2.1583
			8.192**	1.543	1.268				
			1.751*	-0.114					
25	64	66	0.084	-0.011	0.096	0.7388	0.1415	0.5973	0.5949
			7.865**	-1.065	1.200				
			1.123	-0.550					
50	37	37	0.054	0.023	0.031	0.2519	-0.0875	0.3394	0.3381
			4.490**	1.684*	0.246				
			0.406	0.032					

Turkey	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	591	618	0.0309	-0.0348	0.0657	2.5775	3.1079	-0.5304	-0.5338
			0.7532	-0.9331	0.6868				
			0.4236	-0.4223					
5	356	374	0.1765	-0.0779	0.2543	8.9421	4.1936	4.7484	4.7463
			4.2092**	-1.9628*	1.9851*				
			1.7702*	-0.7833					
10	177	185	0.1461	-0.1966	0.3428	3.6613	5.2304	-1.5690	-1.6983
			3.4816**	-4.2090**	1.7347				
			1.0758	-1.2837					
25	80	76	0.0307	-0.4198	0.4506	0.3177	4.5917	-4.2739	-4.3296
			0.6326	-7.8601**	1.2990				
			0.1466	-1.5868					
50	38	41	0.1514	-0.7808	0.9322	0.7883	4.6067	-3.8184	-3.8466
			2.5773**	-11.9801**	1.5781				
			0.3818	-1.7955*					

Lebanon	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	1253	1267	-0.025	-0.011	-0.014	-4.5238	1.9541	-6.4779	-6.5499
			-1.714*	-0.736	-0.590				
			-0.454	0.172					
5	1024	1023	-0.029	-0.005	-0.025	-4.3481	0.7527	-5.1008	-5.1592
			-2.013*	-0.343	-0.905				
			-0.606	0.395					
10	674	650	-0.068	0.013	-0.081	-6.5538	-1.2196	-5.3341	-5.3719
			-4.614**	1.011	-2.488**				
			-1.873*	1.042					
25	217	235	-0.164	0.035	-0.199	-5.1285	-1.1314	-3.9971	-4.0100
			-10.171**	2.306*	-3.192**				
			-3.063**	1.112					
50	71	98	-0.226	0.077	-0.302	-2.3212	-1.0399	-1.2814	-1.2862
			-11.117**	4.947**	-2.484**				
			-2.046*	1.340					

EMU	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	595	640	0.090	-0.016	0.106	7.6170	1.4970	6.1200	6.0318
			4.947**	-0.921	2.467**				
			2.031*	-0.939					
5	343	373	0.106	-0.054	0.160	5.1723	2.9056	2.2667	2.2156
			5.762**	-3.006**	2.777**				
			1.964*	-1.619					
10	173	179	0.167	0.000	0.168	4.1049	0.0443	4.0607	4.0355
			9.342**	-0.021	1.969*				
			2.502**	-0.254					
25	75	76	0.166	-0.062	0.228	1.7441	0.7075	1.0367	1.0259
			8.767**	-3.031**	1.677*				
			1.588*	-0.773					
50	37	46	0.286	-0.085	0.371	1.4791	0.5889	0.8902	0.8843
			12.890**	-3.907**	1.805*				
			1.735*	-0.738					

MENA	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	611	606	0.053	-0.023	0.076	4.6081	1.9844	2.6238	1.8588
			5.644**	-2.214*	0.932				
			1.132	-0.483					
5	371	375	0.051	-0.024	0.074	2.6563	1.3027	1.3536	0.8847
			5.178**	-2.338**	2.409**				
			1.456	-1.627					
	178	187	0.059	-0.068	0.127	1.4695	1.8485	-0.3789	-0.6083
10			6.783**	-5.907**	2.816**				
			1.461	-2.264*					
	79	74	0.063	-0.129	0.192	0.6784	1.3986	-0.7202	-0.8164
25			6.006**	-10.255**	2.412**				
			0.921	-2.309*					
	41	39	0.026	-0.132	0.158	0.1172	0.7683	-0.6511	-0.7014
50			2.369**	-8.600**	1.247				
			0.134	-1.414					

WORLD	N(buy)	N(sell)	Buy	Sell	Buy-Sell	Profit (b)	Profit (s)	Profit (b-s)	Net Profit
2	587	655	0.069	-0.052	0.120	5.7119	4.8535	0.8585	0.7697
			7.199**	-5.143**	5.109**				
			3.315**	-2.889**					
5	352	389	0.084	-0.075	0.160	4.2048	4.2270	-0.0222	-0.0751
			9.491**	-7.651**	5.476**				
			3.576**	-3.410**					
10	179	202	0.074	-0.112	0.185	1.8562	3.2521	-1.3959	-1.4232
			8.671**	-11.450**	4.678**				
			2.421**	-3.775**					
25	75	81	0.077	-0.164	0.241	0.7965	1.9296	-1.1331	-1.1443
			7.725**	-14.835**	3.376**				
			1.462*	-3.177**					
50	37	39	0.109	-0.208	0.317	0.5426	1.1941	-0.6515	-0.6569
			11.488**	-17.322**	3.022**				
			1.567	-2.587**					

References

Abed, T, Soueid M., (2005). Capital markets in the Middle East and North Africa. *EIB-FEMIP Experts Committee Paper*.

Abraham, Aa., F.J. Seyyed, S.A Alsakran, (2002). Testing the random walk behaviour and efficiency of Gulf Stock Market, *The Financial Review, 37, 469-480.*

Al-Loughani, N.E, (1995). Random Walk in thinly traded stock markets: the case of Kuwait, *Arab Journal of Administrative Science, 3, 198-209.*

Bekaert, G. Harvey, C, (1998). Capital markets: an engine for economic growth. *Brown Journal of World Affairs (Winter/Spring), pp.33-53.*

Bessembinder, H., and Chan, K., (1995). The profitability of technical trading rules in the Asian stock markets, *Pacific-Basin Finance Journal 3, 257-284.*

Blavy, R. (2002). Changing volatility in emerging markets: a case study of two Middle Estern stock exchanges, *Revue Entente Cordiale 02*.

Branes Paul, (1986). " Thin trading and stock market efficiency: A case of the Kuala Lumpur Stock Exchange", *Journal of Business Finance & Accounting* , volume 13(4) winter , pp. 609-617.

Brock, W., Lakonishok, J. and LeBaron, B., (1992). Simple technical trading rules and the stochastic properties of stock returns. *Journal of Finance* **47**, pp. 1731–1764.

Butler, K.C., and Malaikah, S.J., (1992), "Efficiency and inefficiency in thinly traded stock markets: Kuwait and Saudi Arabia", *Journal of Banking and Finance*, vol. 16, pp. 197-210.

Blasco, N., Rio, C.D., and Santamaría, R., (1997). The random walk hypothesis in the Spanish stock market: 1980-1992, *Journal of Business Finance & Accounting 24, 667-683.*

Chan Kam C. Gup Benton E., and Pan Ming-shiun, (1992) , "An Empirical Analysis of Stock Prices in Major Asian Markets and United States", *The Financial Review*, vol-27, no-2, May1992, pp-289-307.

Chang E.J, Lima E.J.D, Tabak, B.M (2000), Testing for Weak Form Efficiency in Emerging Markets, *Working Paper, Banco Central do Brazil.*

Cheung, Yan –Leung, Wong Kie-Ann, and Ho Yan-Ki, (1993), "The pricing of risky assets in two emerging Asian markets- Korea and Taiwan", *Applied Financial Economics* 3, issue 4, December, pp.315-324.

Chou, Y. L., (1969), *Statistical Analysts*. London: Holt Rinehart and Winston.

Chow, V.K., and Denning, K.D., (1993). "A simple multiple variance ratio test", *Journal of Econometrics,* vol., 58, pp. 385-401.

Chun I. Lee a, Kimberly C. Gleason b, Mathur I, (2000). Efficiency tests in the French derivatives market, *Journal of Banking and Finance 24, 787-807.*

Civelek, M.A, (1991). Stock market efficiency revisited: evidence from the Amman stock exchange. *The Middle East Business and Economic Review, 3, 27-31*.

Claessens Stijin, Dasgupta Susmita, and Glen Jack, (1995). "Return behaviour in emerging Stock Market", *The World Bank Economic Review*, vol.9, no.1, Pp. 131-151.

Dickinson and Muragu , (1994). " Market Efficiency in Developing Countries: A case study of the Nairobi Stock Exchange", *Journal of Business Finance & Accounting*, volume 21(1) January, pp. 133-150.

Eckbo, B.E. and Liu, J. (1993). "Temporary components of stock prices: new univariate results;", *Journal of Financial and Quantitative Analysis*, vol., 28, pp. 161-176.

Errunza, Vihang R. and Losq, Etienne, (1985). "The behavior of stock prices on LDC markets", *Journal of Banking and Finance*, vol. 9, pp. 561-575.

Fama , E. (1965), "The behavior of Stock Market Prices", *Journal of Business*, vol 38 , p.34-105.
---------- (1970), " Efficient Capital Markets: A review of theory and Empirical Work", *Journal of Finance*, vol-25, no-2(May,1970), Pp.383-417.

Fama, Eugune F.,and Kenneth R.French, (1988), "Permanent and temporary components of stock market prices", *Journal of Political Economy*, vol. 96, pp-246-273.

El-Erian M.A, Kumar M.S, 1995. Emerging equity markets in Middle Eastern countries, *IMF Staff Paper, 42, 313-343*.

Ghandi, D.K. , A. Saunders and R. S. Woodward (1980) , "Thin Capital Markets: A case study of the Kuwait Stock Market " *Applied Economics*, vol-12, (1980).pp.341-349.

Harvey Campbell R., (1994), "Conditional Asset allocation in Emerging Markets", *Working Paper,* No.4623, Cambridge, MA.

Hudson, Robert. Dempsey, Michael and Keasey, Kevin., "A note on the weak-form efficiency of capital markets: The application of simple technical trading rules to UK Stock prices-1935 to 1994", *Journal of Banking & Finance*, vol.20, Pp. 1121-1132.

Hussain, Fazal, (1996), " Stock price Behaviour in an Emerging Market: A case Study of Pakistan", *Ph D thesis*. The Catholic University of America.

Ko Kwang- Soo and Lee Sang-Bin, (1991), "A comparative analysis of the Daily Behavior of Stock Returns: Japan, The US and the Asian NICs", *Journal of Business Finance and Accounting*, vol. 18(2), Pp. 219-234.

Kim, J-L (2005). Wild bootstrapping of joint variance ratio tests, *Working Paper DEBS, Monash University*.

Lagoarde-Segot, T. and Lucey, B., (2005). Financial Integration in the MENA: in search for portfolio diversification opportunities, *IIIS Discussion Paper 71, Trinity College Dublin*.

Lakonishok, J. and S.Smidt, (1988), "Are Seasonal Anomalies Real? A Ninety Year Perspective", *Review of Financial Studies* 1, pp.402-425.

Laurence, Martin M., (1986), "Weak-form efficiency in the Kuala Lumpur and Singapore Stock Markets", *Journal of Banking and Finance*, vol. 10, pp.431-445.

Lo, A. W., and A.C. Mackinlay, (1988), "Stock market prices do not follow random walks. Evidence from a simple specification test", *Review of Financial Studies*, vol.1, pp.41-66.

Lusinyan, L, (2002). International capital flows, economic growth and financial market efficiency. *EUI Working Paper ECO No.2002/20.*

Marone H, (2003). Small African stock markets – The case of the Lusaka stock exchange, *IMF Working Paper 06.*

Mecagni, M, Sourial, M(1999). The Egyptian Stock Market: Efficiency Test and Volatility Effects, *IMF Working Paper 48.*

Nourredine Khababa , (1998), "Behavior of stock prices in the Saudi Arabian Financial Market: Empirical research findings", *Journal of Financial Management & Analysis*, Volume 11(1) , Jan-June, pp. 48-55.

Ojah Kalu and Karemera ,(1999), " Random walks and Market efficiency Tests of Latin Amaeracan Emerging Equity Markets: A Revisit", *The Financial Review* , volume 34, pp. 57-72.

Poshakwale S. (1996), " Evidence on the Weak-form efficiency and the day of the week effect in the Indian Stock Market", *Finance India*, Volume 10(3), September, pp. 605-616.

Singh, A, 1999. Should Africa promote stock market capitalism? *Journal of International Development, Vol.11 (May-June), pp.343-65.*

Smith, G, 2004, Random Walks in Middle East Stock Markets, *Working Paper, University of London.*

Urrutia, J.L., 1995, Test of random walk and market efficiency for Latin American emerging equity markets, *The Journal of Financial Research 18, 299-309.*

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

Institute for International Integration Studies
The Sutherland Centre, Trinity College Dublin, Dublin 2, Ireland