THE EFFICIENCY OF EMERGING STOCK MARKETS: EVIDENCE FROM ASIA AND AFRICA

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ABSTRACT

This paper examines the efficiency in pricing securities as well as the relation between exchange rate and dynamics of equity returns in a number of emerging stock markets from Africa and Asia,. This study utilizes methodologies based on Single variance ratio test of Lo and Mackinlay (1988), multiple variance tests of Chow and Denning (1993), individual variance test based on ranks and signs of Wright (2000), Wild bootstrap test of Chow and Denning introduced by Kim (2006), and joint version of sign test of Wright by Kim and Shamsuddin (2008). Results shows that Egyptian, Moroccan and Indian exchanges are not in conformity with the Random Walk Hypothesis (RWH) from the perspective of both local and international investors. Whereas the first two markets are considered inefficient in pricing equities, from the perspective of both local and international investors, when monthly returns are employed. The Indian market supports that testing for RWH is sensitive to the frequency of data used. It is worth mentioning that empirical results demonstrate also insensitivity of testing of RWH to exchange rate changes. The main significance of our study is the use of the latest test methodologies in analyzing an investment area that is growing in the emerging stock markets.

JEL: G12, G13, G14, G15

KEYWORDS: Emerging Markets, Variance Ratio Test, Wild Bootstrap, Conditional Heteroskedasticity.

INTRODUCTION

Efficiency of stock markets plays important role for the investors to make their investment decision, in fact, it is known that the hypothesis of market efficiency has a strong influence on fund manager international asset allocation. In this light, more and more attention is given to the concept of globalization and movement of investments across countries, and so to emerging markets and their efficiency. Therefore these emerging stock markets become viable alternative for investors seeking international diversifications. According to Random Walk Hypothesis, in efficient market, the asset prices reflect markets' best estimate for the assets' risk and expected return, while in the case of emerging markets are often characterized by a lower volume and frequency of trading and easiness of manipulation by a few larger traders. If correct information fails to be quickly and fully reflected in the stock prices then stock markets are said to be inefficient, who has private information can benefit by anticipating the course of such prices, Borges (2007). Increasing the importance of stock markets in developing countries-emerging markets –is one of the most striking features of the international financial development over the past two decades. This growth is an instrument of increasing the wheel of development in those countries, so for many reasons, the ability to attract inward portfolio investment, improve the pricing and availability of capital for domestic investment, and boost domestic savings. However the ability of emerging stock markets to play that role depends on their efficiency. If they are to help improve the operation of the capital market, then the role of stock markets in the allocation and pricing of capital, and the pricing of risk, is crucial.

The importance of the efficiency of stock markets comes also from the way in which they make evaluation of market firm. The discount rate that represents shareholder's required rate of return is established as a result of benchmark rates in the stock markets such as the Risk-Free Rate (RF) and the

market risk premium. If stock prices accurately reflect future firm performance, then this creates the premises for efficient resource allocation. On the other hand, if stock prices are formed inefficiently, that creates the potential for inappropriate investments in the economy and firms that should face high costs of raising capital are actually able to raise it cheaper, hence the result can be severe social costs.
This evolution in African and Asia stock markets has been based on a number of factors. Where many African and Asian countries have implemented economic reform programs and that in the process of transformation, through privatization programs to maximize the role of the private sector in the national economy. As a result of this transformation markets obtained the power to rule in prices determining and allocate the financial resources. Furthermore, this economic reform has implication on financial sector which lead to establish many of the new stock markets, and improve the existing stock markets through providing a supply of new shares and a further boost to stock market development, that is by involving the listing of shares in formerly nationalized companies.

In order to assess the efficiency of the financial market, many methodologies can be considered, starting from variance ratio tests, introduced by Lo and Mackinlay (1988), by applying single variance ratio test, its direct evolution multiple variance test of Chow and Denning (1993), to variance ratio (VR) based on ranks and signs of Wright (2000), till more recent approaches as Whang–Kim sub-sampling tests of Whang and Kim (2003), and the wild bootstrapping of Chow and Denning test introduced by Kim (2006).

The purpose of this paper is to contribute to the debate by examining some issues concerning the efficiency of market and the relation between exchange rate and equity returns. These issues have not been examined so far for both Asian and African stock markets together, so this paper attempts to fill that gap by addressing the following objectives, which are (1) to examine the Random Walk Hypothesis (RWH) for stock prices in Asian and African emerging Markets. This theory affirms that stock price changes have the same distribution and are independent of each other, so the past movement or trend of a stock price or market cannot be used to predict its future movement. (2) to determine whether exchange rates affect tests of equity returns in emerging markets. (3) to investigate whether large capitalization stocks follow a random walk. The main significance of our study of these objectives is the use of the latest test methodologies in analyzing an investment area that is growing in the emerging stock markets. The rest of this paper is organized as follows: Section 2 describes a survey of the previous works in this area. Section 3 presents methodology used to analyze the role of the financial analysts' information to feed the bubble, while Section 4 discusses the data and next one empirical results. Section 6 provides some concluding remarks.

LITERATURE REVIEW

This paper is concerned with testing for the consistency with the random walk hypothesis (RWH) in some selected stock exchanges in Africa and Asia. Very huge evolution in testing for the RWH took place during the past decades. Literature includes many direct tests aims at investigating whether stock prices are predictable based upon past prices as technical analysis in Elaine (2007). It is well known that unit root tests (e.g. Augmented Dickey-Fuller test) lack power and, therefore, they are unable to reject the RWH against the stationarity alternative when the null hypothesis is, in fact, false, though improvement are achived by and unit root tests of Marashdeh and Shrestha (2008).

Since the seminal paper of Lo and Mackinlay (1988) in which they introduced their VR test, many empirical studies applied the test or more sophisticated versions of VR as introduced by Chow and Denning (1993).

Lo and Mackinlay (1988) introduced their single variance ratio (VR) tests by utilizing the property of random walk that if the natural logarithms of asset prices follow a random walk, then the variance q-difference of asset prices should be q times of its first difference. In other words, VR (q) of (1/q) th of the variance of q-holding -period return to that of one-holding-period return has to be unity for all q. They derived two test statistics, under the assumptions of homoscedasticity and heteroskedasticity, which are asymptotically normally distributed. Since then, the methodology of VR has been received a lot of attention and developments. Chow and Denning (1993) criticized the aforementioned VR tests where the null hypothesis is tested for an individual value of holding period, q. They argued that question as whether or not stock prices obey the RWH requires that the null hypothesis hold true for all holding periods of q. Accordingly, this necessitates conducting a joint test where a multiple comparison of VRs over a set of different time horizons is made. So, the weakness of approach of Lo–MacKinlay is that it ignores the joint nature of testing for the RWH and, thus, it may involve much larger Type I error than the nominal level of significance. To avoid this problem, Chow–Denning (1993) invented a joint test with controlled size. They treated the test statistics of Lo and Mackinlay (1988) as Studentized Maximum Modulus (SMM) variates.

Both Lo–MacKinlay and Chow–Denning tests are asymptotic tests, whose sampling distributions are approximated based on their limiting distributions, which may have deficiencies especially when the sample size is not large enough to justify asymptotic approximations. To overcome this problem, literature proceeded into two directions. First, Wright (2000) introduced new VR tests based on ranks and signs which are exact tests. Wright's (2000) tests have two advantages over Lo–MacKinlay and Chow–Denning tests when sample size is relatively small: (1) the sign and rank tests have exact sampling distribution and, hence, there is no need to resort to asymptotic approximation and (2) sign and rank tests are more powerful than the conventional VR tests when the data are highly non-normal. Second, Kim (2006) established the wild bootstrap of the test statistic robust for heteroskedasticity of Chow and Denning (1993). By employing bootstrap, a re-sampling method which approximates the sampling distribution of a statistic, Kim (2006) tackled the problem of small samples. Taking into account that the test introduced by Kim (2006) does not ignore the joint nature of the VRs in testing for the RWH and it is applicable to data with unknown forms of conditional and unconditional heteroskedasticity, it is considered to be one of the most important tests employed for the RWH. Kim and Shamsuddin (2008) reported that Monte Carlo simulations test of non-parametric tests show superior small sample properties to those of the conventional Chow–Denning test.

Smith et al (2002) applied the methodology of multiple variance ratios of Chow and Denning (1993) to test for RWH in a number of African markets. They divided the studied markets into four groups: big-sized market [e.g. South Africa], medium-sized markets (e.g. Egypt), small new markets, including exchanges experienced rapid growth, (e.g. Botswana and Ghana), and small new markets (e.g. Zambia and Malawi) which have yet to take off. Using weekly data, their results showed that the RWH null hypothesis is rejected for all stock markets, with the exception of South Africa which is found to be consistent with the RWH. The South African exchange obeying the RWH can be attributed to the fact that its financial sector is relatively sophisticated which facilitates information flows, in a manner that one would expect of a developed stock market, to all market participants. The authors reported number of reasons for efficiency of the South African stock market such as; size, as the value of capitalization and turnover on South Africa stock market is ten times of the next largest market, liquidity that because of the low level of turnover for some stocks which are not traded from one period to the next, and the fact that Africa stock market is more `institutionally mature' than other African markets.

Employing joint variance ratio tests based on ranks and signs and wild bootstrapping Chow and Denning (1993) test, Smith and Rogers (2006) used data of four stock index futures and 36 single stock futures to investigate the weak-form efficiency. They confirmed the evidence of efficiency for South Africa stock market Smith et al (2002), with exception of 11 of the single stock futures rejected RWH. This rejection caused by the noise effect which is common especially in individual stock prices and single stock futures causing detection of predictable components difficult.

For examining the presence of random walk in Istanbul Stock Exchange (ISE), Buguk and Brorsen (2003) followed four different tests the Augmented Dickey–Fuller test, GPH fractional integration test of Cheung and Lai(1993) , single variance ratio test of Lo and Mackinlay (1988) and finally single VR based on ranks and signs of Wright (2000). Using weekly data for the time period 1992 to 1999. All the tests employed confirmed the presence of random walk except the rank- and sign-based variance ratio test shows inconsistency with RMH. This rejection is caused by the weakness of the tests used and the advantage of Wright's test (2000) over the others tests, as the sign and rank tests have exact sampling distribution and, hence, there is no need to resort to asymptotic approximation ,and they are more powerful than the conventional VR tests when the data are highly non-normal.

To investigate whether the stock price index in Emirates securities markets meets the criterion of weak form market efficiency, Marashdeh, and Shrestha (2008) applied Perron (1997) models to test for a unit root in the presence of one endogenously determined structural break. Using daily stock market index data over the period 31 August 2003 to 13 April 2008, the test demonstrated that the Emirates securities market data contains unit root and follow a random walk, which approved that the market meets the criterion of weak form market efficiency. The results are contradict with the one which Squalli (2006) obtained. As he employed the VR of LO and Mackinlay (1988) and the non-parametric runs tests to investigate whether the Dubai Financial Market (DFM) and the Abu Dhabi Securities Market (ADSM) are in conformity with the RWH. Employing daily data of sector indexes for the period 2000-2005, he found that, except for the banking sector in the DFM, VRs are significantly less than unity. This implies the presence of negative serial correlation in employed return series which can be seen as an indicator for the presence of bubble in an emerging market. Interestingly, the contradiction of the results is illustrated by the difference of methodologies.

Using VR of Lo and Mackinlay (1988) solved the shortcomings of unit root test as they are lack power and, therefore, they are unable to reject the RWH against the stationarity alternative when the null hypothesis is, in fact, false. Hoque et al (2007) examined eight emerging equity markets in Asia (Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand). He employed four tests to test whether returns of these markets obey the martingale difference sequence, namely single VR test of Lo and Mackinlay (1988), multiple MVR test of Chow and Denning (1993), single VRs based on ranks and signs of Wright (2000), and sub-sampling tests of Whang and Kim (2003). Using weekly price data for time period 1990 to 2004, the author found evidence of an inefficient for all eight emerging equity markets with exception for Taiwan and Korea which obey RMH.

To test for the RWH in a number of Asian markets, Kim and Shamusuddin (2008) employed three versions of multiple variance ratio; namely Chow and Denning (1993) test, the wild bootstrapping of Chow and Denning test introduced by Kim (2006), and joint signs of Wright (2000). Using daily and weekly data from 1990 to 2005, their empirical results showed consistency of Hong Kong, Japanese, Korean and Taiwanese markets with RWH. On the other hand, Indonesia, Malaysia and Philippines are found to be inconsistent with RWH. Empirical results demonstrated also changes in some stock markets behavior after the Asian crisis. For example, Singaporean and Thai markets have obeyed the RWH after the Asian crisis in 1997. Mishra et al (2009) studied the efficiency of Indian stock market during the global financial crisis. The study utilized methodology based on Augmented Dickey-Fuller test and Poterba and Summers (1988) implication of market inefficiency. Employing daily stock returns, the author suggested the existence of mean reversion illusion in India. In the same research context, some years before, Gupta et al., (2007), find evidence of weak form of efficiency for Indian Stock Market.

ECONOMETRIC METHODOLOGY

The current part of the study is concerned with introducing different versions of VRs used to test for the RWH which is equivalent to testing for weak-form market efficiency. The methodology of VRs, used in

this paper, is based on the fact that variance of the random walk is positively correlated with time and the relationship between them is linear. This property of the random walk is applicable for strong random walk, where returns are independently and identically distributed (IID) as represented by equation (1) and weak random walk where returns follow martingale difference sequence (MDS) .(Campbell et al., (1997)).
Consider the following equation to describe random walk model.

$$\rho_t = \mu + \rho_{t-1} + \varepsilon_t , \qquad \varepsilon_t \sim \mathrm{IID}(0, \sigma^2) \qquad (1)$$

Or

$$\alpha_t = \mu + \varepsilon_t, \qquad \varepsilon_t \sim \mathrm{IID}(0, \sigma^2) \qquad (2)$$

Whereρ_t donate the log of the return series under the consideration of time , μ is drift parameter and the expected value of random error term ε_t is zero for all t, finite variance and they (ε_t) are independently and identical distributed (IID). So, any conditional heteroskedasticity is excluded.

Single Variance Ratio of Lo and Mackinlay (1988)

Lo and Mackinlay (1988) introduced their single variance ratio (VR) tests by utilizing the property of random walk that if the natural logarithms of asset prices follow a random walk, then the variance *q*-difference of asset prices should be *q* times of its first difference. In other words, *VR (q)* of *(1/q) th* of the variance of *q*-holding -period return to that of one-holding-period return has to be unity for all *q*. They derived two test statistics, under the assumptions of homoscedasticity and heteroskedasticity, which are asymptotically normally distributed. Since then, the methodology of VR has been received a lot of attention and developments.

$$VR(q) = \frac{\sigma^2(q)}{\sigma^2(1)} \qquad (3)$$

Where σ^2 (q) is the unbiased estimator of 1/q of the variance of the qth difference and $\sigma^2(1)$ is the variance of the first difference. Where σ^2 (q) and $\sigma^2(1)$ can be calculated as the following:

$$\sigma^2(q) = \frac{1}{m}\sum_{t=q}^{nq}(\rho_t - \rho_{t-q} - q\mu)^2 \qquad (4)$$

Where:

$$M = q(nq - q + 1)\left(1 - \frac{q}{nq}\right)$$

And

$$\sigma^2(1) = \frac{1}{(nq-1)}\sum_{t=1}^{nq}(\rho_t - \rho_{t-1} - \mu)^2 \qquad (5)$$

Where:

$$\mu = \frac{1}{nq}(\rho_{nq} - \rho_0)$$

ρ_0 *and* ρ_{nq} are the first and last observations of the time series.

Lo and Mackinlay (1988) derived two test statistics to test for RWH under the assumptions of both homoscedasticity and heteroskedasticity. These test statistics are represented below by equations (6) and (7) respectively. Both test statistics are asymptotically, and normally distributed with mean zero and variance M1(q) and M2(q) are (0,1). As the test statistics are normally distributed with (0,1), the critical values of the standard normal distribution are used to make the decision rule. Accordingly, if the absolute value of the calculated test statistics (i.e. M1(q) and M2(q)) exceeds the critical values of 2.58(1%) and 1.96(5%),the null hypothesis of RWH should be rejected at 1% and 5% levels of significance respectively.

$$M1(q) = \frac{VR(q)-1}{(V*(q))^{1|2}} \quad N(0,1) \tag{6}$$

$$M2(q) = \frac{VR(q)-1}{(V*(q))^{1|2}} \quad N(0,1) \tag{7}$$

Where M1(q) and M2(q) represent the asymptotic Variance respectively under homoscedasticity and heteroskedasticity. If VR does not significantly differ from one, the null hypothesis of RWH is accepted. If VR significantly exceeds one, the null hypothesis of RWH is rejected which indicating that returns are positively serially correlated. If VR significantly found to be less than unity, the null hypothesis of RWH is reject with negatively serially correlated returns which match with findings of Lo and Mackinlay (1988).

<u>Multiple Variance Tests of Chow and Denning (1993)</u>

Multiple variance ratios (MVR) of Chow and Denning (1993) used the Studentized Maximum Modulus (SMM) distribution to conduct such joint test. They criticized VR tests where the null hypothesis is tested for an individual value of holding period, q. They argued that question as whether or not stock prices obey the RWH requires that the null hypothesis hold true for all holding periods of q. Accordingly, this necessitates conducting a joint test where a multiple comparison of VRs over a set of different time horizons is made. So, the weakness of approach of Lo–MacKinlay is that it ignores the joint nature of testing for the RWH and, thus, it may involve much larger Type I error than the nominal level of significance. Namely, the probability of incorrect rejection of the true null hypothesis can be quite larger than the chosen level of significance. To avoid this problem, Chow–Denning (1993) invented a joint test with controlled size. They treated the test statistics of Lo and Mackinlay (1988) as Studentized Maximum Modulus (SMM) variates.

$$Mr(q) = \frac{\sigma_q^2(q)}{q\sigma_1^2(q)} - 1.0 \tag{8}$$

As Mr (q_i) is a set of m variance ratio estimates=1,2,…. and m corresponding to selected values of the aggregation (observation) intervals (q_i). Under the random walk hypothesis which are:

$$H_{0i}: M_r(q_i) = 0 \qquad for\ i = 1,2,\dots$$
$$H_{1i}: M_r(q_i) \neq 0 \qquad for\ any\ i$$

These two statistics are appropriate to test an individual variance ratio, i.e. for a given value k. However, under the null hypothesis any variance ratio must be equal to one, so that a more powerful approach is a comparison of all selected variance-ratios with unity. Let k_i be any integer greater than one with $k_i \neq k_j$ for $i \neq j$, Chow and Denning formulate the null hypothesis as H0 : V R(k_i) = 1 for i = 1; 2,…,m, and define their statistics as:

$$\mathrm{MVR}_1(\mathrm{m}) = \max_{1 \le i \le m} |\mathrm{MVR}_1(\mathrm{K_i})|$$
$$\mathrm{MVR}_2(\mathrm{m}) = \max_{1 \le i \le m} |\mathrm{MVR}_2(\mathrm{K_i})|$$

Single VR Based on Ranks and Signs of Wright (2000)

Both Lo–MacKinlay and Chow–Denning tests are asymptotic tests, whose sampling distributions are approximated based on their limiting distributions, which may have deficiencies especially when the sample size is not large enough to justify asymptotic approximations. Wright (2000) introduced new VR tests based on ranks and signs of the returns series which are exact tests.

Given the series of asset returns, ε_t with associated ranks r(ε_t), Wright (2000) defined two random variables:

$$r_{1t} = \left(r(\varepsilon_t) - \frac{T+1}{2}\right) \Big/ \sqrt{\frac{(T-1)(T+1)}{12}} \tag{9}$$

Which has sample mean and variance of 0 and 1, respectively, and

$$r_{2t} = \phi^{-1}(r(\varepsilon_t) \big/ (T+1)) \tag{10}$$

As $r(\varepsilon_t)$is the rank of y_t among $\varepsilon_1, \varepsilon_2, \varepsilon_3, \ldots\ \varepsilon_T$ in the first equation, for the second one ϕ is defined to be the standard cumulative distribution function. The series of r_{1t} should be simple linear transformation of the ranks while r_{2t} is inverse normal. Both are with sample mean zero and sample variance approximately one.

The null hypothesis of random walk is rejected if observed R1, R2, and S exceed their corresponding values obtained from Monte Carlo simulation, which are shown as following:

$$R_1 = \left(\frac{\frac{1}{Tq}\sum_{t=q+1}^{T}(r_{1t}+r_{1r-1}+\cdots+r_{1t-q})^2}{\frac{1}{T}\sum_{t=1}^{T} r_{1t}^2} - 1\right)\left(\frac{2(2q-1)(q-1)}{3qT}\right)^{-1/2} \tag{11}$$

$$R_2 = \left(\frac{\frac{1}{Tq}\sum_{t=q+1}^{T}(r_{2t}+r_{2r-1}+\cdots+r_{2t-q})^2}{\frac{1}{T}\sum_{t=1}^{T} r_{2t}^2} - 1\right)\left(\frac{2(2q-1)(q-1)}{3qT}\right)^{-1/2} \tag{12}$$

Wright (2000) used the signs of returns instead of its ranks to modify the variance ratio tests which imply for any series y_t as u ($y_t > q) - 0.5$ by getting result whether is $\frac{1}{2}$ if y_t is positive or -$\frac{1}{2}$ if $y_t$is negative. as S_t=2u (y_t, 0)=2u, where S_t is a series with mean equal to zero and variance equal to the unit.

S_t takes value 1 with probability -$\frac{1}{2}$ and -1 with probability $\frac{1}{2}$, variance ratio tests using signs returns can be define as the following :

$$S=\left(\frac{\frac{1}{Tq}\sum_{t=q+1}^{T}\left(s_t+s_{t-1}+\cdots.+s_{t-q}\right)^2}{\frac{1}{T}\sum_{t=1}^{T} s_t^2} - 1\right)\left(\frac{2(2q-1)(q-1)}{3qT}\right)^{\frac{-1}{2}} \tag{13}$$

Wild bootstrap of Chow and Denning Test Introduced by Kim (2006)

The wild bootstrap of MVR2 test statistic of Chow and Denning (1993) introduced by Kim (2006) is alternative of VR tests, as it is re-sampling method which approximates the sampling distribution of a statistic. The test is applicable to data with unknown forms of conditional and unconditional heteroskedasticity. This test has to be considered recently as mostly effective for econometrics problems. The test based on three stages:

1. Form bootstrap sample of T observations $\varepsilon_t^* = \eta_t \varepsilon_t$ (t =1,. . . T) Where η_t is a random sequence with $E(\eta_t)=0$ and $E(\eta_t^2)=1$.
2. Calculate MVR2*= MVR2 (ε^*, q_j), the MVR2 (ε, q_j) statistic obtained from the bootstrap sample.
3. Repeat (1) and (2) sufficiently many m times to form a bootstrap distribution of the test statistic$\{MVR2\ (\varepsilon^*;\ qj;\ j)\}_{j-1}^{m}$.
4. The test of P value can be calculated as the proportion of $\{MVR2\ (\varepsilon^*;\ qj;\ j)\}_{j-1}^{m}$ greater than the sample value of MVR2 (ε, q_j).

Joint Sign Test Introduced by Kim and Shamsuddin (2008)

Kim and Shamsuddin (2008) joint tests have superior size and power properties in small samples compared to conventional multiple horizon variance ratio tests. As the Joint sign statistic also has an exact sampling distribution, and its critical values can be obtained by simulation in a similar way as that of S given in equation (13). The null hypothesis is rejected when the observed JS statistic is greater than the critical value.

Data

In this paper the main data comprises weekly and monthly national stock prices indices in both domestic (local) currency and the US dollar for 6 emerging stock markets form Africa and Asia. Egypt, Morocco and South Africa are chosen to be as representatives of Africa .On the other hand, India, China, and Indonesia are chosen to be as representatives of Asia. These national stock indices are obtained from Thomson Financial DataStream (MSIC). The MSIC stock indices are value-weighted and are reformed for dividend payments. Three of these 6 series China, India, and South Africa cover the period from 1/1/1993 to 1/1/2010, while two series Egypt and Morocco run a little shorter from to 12/30/1994 to 1/1/2010. Finally Indonesia from 12/30/1990 to1/1/2010. The examining evidences have very importance role in Asia and Africa. Indeed, all these markets are characterized with the rapid growth, the commitment to the rules of the international market, and furthermore, these markets have different economic and institutional systems, which would confer on the search side of the comparison and variety.

Using local currency and US dollar for a reason that exchange rates affect in the determination of emerging markets' stock returns' dynamics. The attractiveness of investing in emerging markets, especially in the countries which are well known with exchange rate regime instability, depends on the different equity dynamics return for international and local investors.

The tests in this paper are based on asymptotic approximations, which require a large number of observations. Using weekly and monthly data are deriving a large number of observations and lower biased than daily. Therefore, weekly and monthly are the ideal alternative of using daily data.

EMPIRICAL RESULTS

Empirical Results from Local Investors' Perspective

Tables (3) and (4) show results of VR tests, based on Lo and Mackinlay (1988) approach, on weekly and monthly returns denominated in local currencies, for intervals 2, 4, 8, and 16, with the base of one week (month). From Table (1), except for Egypt in interval 2 when M2(q) is employed, the RWH has to be rejected, at conventional levels of significance, for Egypt and Morocco as the VRs are found to be significantly larger than one for all holding periods whether M1(q) or M2(q) is used. This result indicates that return series in both Egypt and Morocco are positively serially correlated which agree with the fact that these stock exchanges witnessed growth during the investigated period. It is worth mentioning that rejections under heteroskedasticity, for Egypt and Morocco, are weaker than rejections under the assumption of homoscedasticity as indicated by the fact that each M2(q) is less than its corresponding M1(q). Thus, RWH is partially rejected due to changes in variance but the main reason for such rejections is still the violation of randomness as the test statistic M2(q), which is robust for heteroskedasticity, reject the null of RWH. On the other hand, according to the test statistic robust for heteroskedasticity M2(q), all other markets are said to be efficient in pricing securities as the null hypothesis of RWH has to be accepted except for India in intervals 4 and 16.

Table (1): Variance Ratio Tests for Intervals 2, 4, 8, and 16 on Weekly Returns - (Local Currencies)

Index	Egypt	Morocco	South Africa	India	China	Indonesia
No of obs.	783	783	887	887	887	992
q = 2	VR(q)= 1.089	VR(q)= 1.115	VR(q)=0.981	VR(q)= 1.053	VR(q)= 0.9862	VR(q)= 0.9651
	M_1(q)= 2.435** [×]	M_1(q)= 3.100* [√]	M_1(q)=-0.624	M_1(q)= 1.505	M_1(q)=-0.4963	M_1(q)=-1.157
	M_2(q)= 1.842	M_2(q)= 2.103** [×]	M_2(q)=-0.4480	M_2(q)= 1.205	M_2(q)=-0.3860	M_2(q)= -0.6744
q = 4	VR(q)= 1.235	VR(q)= 1.277	VR(q)=1.011	VR(q)=1.178	VR(q)= 1.099	VR(q)= 1.070
	M_1(q)= 3.380* [√]	M_1(q)=3.980 * [√]	M_1(q)= 0.0732	M_1(q)= 2.710* [√]	M_1(q)=1.462	M_1(q)=1.074
	M_2(q)= 2.476** [×]	M_2(q)= 2.773* [√]	M_2(q)=0.0543	M_2(q)=2.168** [×]	M_2(q)=1.172	M_2(q)= 0.6424
q = 8	VR(q)= 1.483	VR(q)= 1.441	VR(q) =1.063	VR(q) =1.255	VR(q)= 1.246	VR(q)= 1.260
	M_1(q)= 4.318* [√]	M_1(q)= 3.903* [√]	M_1(q)= 0.468	M_1(q)=2.371** [×]	M_1(q)= 2.283** [×]	M_1(q)=2.587* [√]
	M_2(q)= 3.129* [√]	M_2(q)= 2.859* [√]	M_2(q)=0.3501	M_2(q)=1.940	M_2(q)=1.845 [×]	M_2(q)=1.545
q = 16	VR(q)=1.945	VR(q)= 1.707	VR(q) =1.053	VR(q)=1.391	VR(q)= 1.363	VR(q)=1.239
	M_1(q)= 5.542 * [√]	M_1(q)= 4.054* [√]	M_1(q)= 0.1232	M_1(q)=2.331** [×]	M_1(q)= 2.152** [×]	$_1$(q)= 1.449
	M_2(q)= 4.115* [√]	M_2(q)=3.136 * [√]	M_2(q)= 0.094	M_2(q)=1.972** [×]	M_2(q)=1.777	M_2(q)=0.9054

**, ** indicate significance at 1% and 5% when compared with critical values of 2.576 and 1.96 (of the standard normal distribution) respectively. The symbol [√] indicates that the VR is statistically different from unity at the 5% level of significance when compared with the SMM critical value of 2.491. The symbol [×] indicates an inferential error in which the variance ratios are separately statistically different from unity according to the standard normal distribution critical values, however; they are insignificant compared with the SMM distribution critical values.*

According to Table (2), the VRs are found to be significantly larger than unity for all holding periods, whether M1(q) or M2(q) is employed, implying the presence of positive serial correlation in Egyptian return series. In contrast, as indicated by the test statistic robust for heteroskedasticity M2(q), all other markets are found to be efficient in pricing equities as the null hypothesis of prices obey the RWH has to be accepted except for Morocco in intervals 8 and 16. In Tables (1) and (2), the calculated test statistics are compared with the SMM distribution critical value of 2.491 (corresponding to a 5% level and m=4). It appears that as calculated test statistics are large enough, for example Egyptian weekly returns for intervals 8 and 16 and monthly return in all holding periods, the RWH is rejected when critical value of SMM distribution is employed. Hence, Egyptian weekly and monthly returns (local currency) are not consistent with RWH according to both single and multiple VR tests. On the other hand, when test statistics are not large enough, for example weekly Indian returns in interval 16 and monthly returns of Morocco in holding period 8, inferential errors have been highlighted. Such inferential errors arisen from using the single VR tests and ignoring the joint nature of the VR approach to testing the RWH. Accordingly, an incorrect rejection of the null hypothesis of the RWH is made when calculated test statistics are compared with critical values of standard normal distribution and not by the critical value of SMM distribution.

Table (2): Variance Ratio Tests for Intervals 2, 4, 8 and 16 on Monthly Returns

Index	Egypt	Morocco	South Africa	India	China	Indonesia
No of obs.	**180**	**180**	**203**	**203**	**203**	**228**
q = 2	VR(q)=1.276	VR(q)= 1.049	VR(q)= 0.991	VR(q)= 1.134	VR(q)= 1.114	VR(q)= 1.154
	M_1(q)=3.505* [√]	M_1(q)=0.5022	M_1(q)=-0.2603	M_1(q)= 1.745	M_1(q)=1.472	M_1(q)= 2.175** [×]
	M_2(q)= 2.713* [√]	M_2(q)= 0.429	M_2(q)= 0.2631	M_2(q)=1.676	M_2(q)=1.056	M_2(q)=1.560
q = 4	VR(q)=1.645	VR(q)= 1.255	VR(q)=0.984	VR(q)= 1.241	VR(q)= 1.216	VR(q)= 1.103
	M_1(q)= 4.240* [√]	M_1(q)= 1.536	M_1(q)=-0.344	M_1(q)= 1.557	M_1(q)= 1.374	M_1(q)= 0.602
	M_2(q)=3.505 * [√]	M_2(q)= 1.340	M_2(q)= 0.3011	M_2(q)=1.536	M_2(q)=1.039	M_2(q)=0.4421
q = 8	VR(q)=2.240	VR(q)= 1.611	VR(q)= 0.883	VR(q)= 1.361	VR(q)= 1.146	VR(q)= 1.175
	M_1(q)=4.847 * [√]	M_1(q)= 2.215** [×]	M_1(q)= -0.851	M_1(q)= 1.296	M_1(q)= 0.330	M_1(q)= 0.528
	M_2(q)=4.183* [√]	M_2(q)= 1.973** [×]	M_2(q)= -0.729	M_2(q)=1.267	M_2(q)=0.261	M_2(q)= 0.398
q = 16	VR(q)=2.740	VR(q)= 2.332	VR(q)= 0.838	VR(q)= 1.167	VR(q)= 1.183	VR(q)= 0.9093
	M_1(q)= 3.968* [√]	M_1(q)= 2.924* [√]	M_1(q)= -0.911	M_1(q)= 0.003	M_1(q)= 0.047	M_1(q)= -0.7110
	M_2(q)= 3.656* [√]	M_2(q)= 2.776 * [√]	M_2(q)= 0.7290	M_2(q)=0.0021	M_2(q)=0.0383	M_2(q)= -0.5571

**, ** indicate significance at 1% and 5% when compared with critical values of 2.576 and 1.96 (of the standard normal distribution) respectively. The symbol [√] indicates that the VR is statistically different from unity at the 5% level of significance when compared with the SMM critical value of 2.491. The symbol [×] indicates an inferential error in which the variance ratio is separately statistically different from unity according to the standard normal distribution critical values, however; it is insignificant compared with the SMM distribution critical values*

These findings agree with findings of Karemera et al (1999) and Chow and Denning (1993) who highlighted inferential errors arisen from using the single VR tests and ignoring the joint nature of the VR approach to testing the RWH). For this reason, caution should be paid to research employed the single VR of Lo and Mackinlay (1988) in testing for RWH.

Taking into account that both Lo and Mackinlay (1988) and Chow and Denning (1993) tests are asymptotic tests may show small sample deficiencies as their sampling distributions are approximated by their limiting distribution. We employ VR test based on ranks and signs introduced by Wright (2000). Based on 5000 Mont Carlo trials, as described in Wright (2000), Table (3) presents the critical values of R1, R2, and S1 tests associated with the sample sizes and holding periods.

Results of VR tests based on ranks and signs for weekly and monthly returns of employed indexes, when returns are denominated in local currencies, are reported in Table 6-panels A and B respectively. R1, R2, and S1 statistics do agree in rejecting the null of RWH for all holding periods, at 1% level of significance, for weekly returns of Morocco – as the observed test statistics are greater than their corresponding critical values obtained from Monte Carlo simulation reported in Table 2.

Similarly, except for R1in intervals 8 and 16 for weekly returns, the three test statistics agree in rejecting the null of RWH for all holding periods, at 1% level of significance, for weekly and monthly returns of

Egypt. All rejections are in the right tail of the distribution implying that return series of Morocco and Egypt are positively serially correlated. With contradiction of results based on the methodology of Lo and Mackinlay (1988), the Chinese stock exchange is found to be violating the RWH.

The null is rejected according to the three test statistics in intervals 2 and 4, for monthly returns and in intervals 8 and 16 for weekly returns. The aforementioned test statistics agree that weekly and monthly returns of South Africa in all intervals, monthly returns of India for all holding periods, and monthly returns of Indonesia in intervals 4, 8, and 16 obey the RWH.

Table (3): Critical Values for WRIGHT's R1, R2, and S1

Sample size		**Holding period**							
		q=2		q=4		q=8		q=16	
		1%	5%	1%	5%	1%	5%	1%	5%
T=783 :	R_1	-2.644, 2.51	-2.027 , 1.921	-2.490 ,2.560	-1.980 ,1.920	-2.573 ,2.521	-1.989 ,1.899	-2.403,2.617	-1.966 ,1.830
	R_2	-2.596, 2.495	-1.996, 1.894	-2.624 ,2.555	-1.976 ,1.929	-2.508 ,2.639	-1.991,1.879	-2.356,2.617	-1.950,1.823
	S_1	-2.68 , 2.609	-2.037, 1.965	-2.521,2.559	-1.948 , 2.043	-2.422,2.712	-1.915 ,2.011	-2.322,2.750	-1.859,1.936
T= :887	R_1	-2.577,2.504	-2.034 ,1.865	-2.538,2.442	-1.936,1.903	-2.504 ,2.517	-1.962 ,1.897	-2.417,2.467	-1.957,1.807
	R_2	-2.574,2.494	-2.065 ,1.904	-2.481, 2.485	-1.945 ,1.907	-2.461 ,2.547	-1.966 ,1.888	-2.428 ,2.522	-1.961 ,1.856
	S_1	-2.518 ,2.383	-1.913 , 1.846	-2.512, 2.584	-1.956 ,1.938	-2.383 ,2.701	-1.924 ,1.958	-2.305,2.629	-1.861 ,1.889
T= :992	R_1	-2.682,2.486	-2.057,1.875	-2.576,2.507	-1.983,1.915	-2.492,2.703	-1.993,1.839	-2.416,2.672	-1.948,1.854
	R_2	-2.691,2.559	-2.025,1.902	-2.561,2.538	-2.018,1.892	-2.510,2.736	-2.008,1.881	-2.486,2.628	-1.959,1.849
	S_1	-2.540,2.540	-1.968,1.841	-2.511,2.596	-1.968,1.934	-2.388,2.661	-1.926,1.948	-2.308,2.672	-1.916,1.951
T= :180	R_1	-2.801,2.451	-2.186,1.797	-2.580,2.619	-2.053,1.843	-2.379,2.705	-1.943,1.849	-2.090,2.409	-1.835,1.577
	R_2	-2.776,2.457	-2.220,1.804	-2.598,2.618	-2.061,1.807	-2.345,2.702	-1.961,1.769	-2.090,2.379	-1.834,1.615
	S_1	-2.683,2.534	-2.086,1.792	-2.430,2.550	-1.992,2.550	-2.204,2.759	-1.852,1.864	-2.002,3.018	-1.744,1.909
T= :203	R_1	-2.702,2.472	-2.089,1.762	-2.494,2.589	-2.004,1.860	-2.367,2.554	-1.981,1.761	-2.121,2.588	-1.892,1.660
	R_2	-2.759,2.502	-2.073,1.776	-2.477,2.544	-1.969,1.796	-2.353,2.494	-1.953,1.726	-2.124,2.444	-1.862,1.589
	S_1	-2.456,2.596	-1.895,1.895	-2.288,2.701	-1.876,1.950	-2.183,2.799	-1.815,2.017	-1.997,3.049	-1.718,1.989
T= :228	R_1	-2.694,2.525	-2.044,1.874	-2.495,2.493	-1.991,1.831	-2.356,2.640	-1.986,1.816	-2.189,2.491	-1.890,1.643
	R_2	-2.759,2.454	-2.065,1.858	-2.454,2.374	-1.996,1.828	-2.339,2.439	-1.970,1.793	-2.124,2.333	-1.871,1.613
	S_1	-2.649,2.384	-2.119,1.854	-2.442,2.655	-1.946,1.876	-2.261,2.720	-1.858,1.936	-2.117,2.817	-1.756,1.916

The critical values were simulated with 5000 replications in each case. The 1 %(5%) critical values represent the 0.5^{th} (2.5^{th}) and 99.5^{th} (97.5^{th}) percentiles of the simulated distribution.

Motivated by the fact that the RWH is a joint hypothesis in the context of the variance ratio tests and the fact that the use of single test for a joint hypothesis would induce size distortion, results of multiple variance ratio tests (namely, Chow and Denning (1993) test, the wild bootstrap of Chow and Denning (1993) test introduced by Kim (2006), and the joint version of Wright's (2000) sign test (JS1) introduced by Kim and Shamsuddin (2008) are presented in Table (5).

According to JS1, weekly return series of all indexes, except for South Africa, are found to disobey the RWH. For weekly returns, the null of not violating RWH has to be rejected for two countries (Egypt and Morocco) when test statistic of Chow and Denning robust for heteroskedasticity (MVR2) is employed and for three countries (Egypt, Morocco, and India) when the wild bootstrap of Chow and Denning (1993) is used.

For monthly returns, the three multiple variance ratio tests do not support the random behaviour of Egyptian and Moroccan returns whereas the random behaviour is supported by the three tests for South African, Indian and Indonesian returns. For monthly returns of China, the JS1 statistic only indicates disobedience of the RWH.

Empirical Results from International Investors' Perspective

Results of VR tests, based on the Methodology of Lo and Mackinlay (1988), on weekly (monthly) returns denominated in US dollar currencies, for intervals 2, 4, 8, and 16, with the base of one week (month) are shown in Table (6) and (7) respectively. For weekly returns, except for Morocco and India in interval 2 when M2 (q) is employed, the null hypothesis of RWH has to be rejected at conventional levels of significance whether M1(q) or M2(q) is used for Egypt, Morocco and India.

Table (4): Results of WRIGHT's Ranks and Signs Tests for Weekly and Monthly Returns (Local currencies)

Country	**Panel A- Weekly Returns**			
	Holding Period			
	q=2	q=4	q=8	q=16
Egypt	R_1=3.976*	R_1=4.640*	R_1=0.030	R1=0.097
	R_2=3.429*	R_2=4.070*	R_2= 4.603*	R2=5.711*
	S_1=3.466*	S_1= 4.259*	S_1= 4.711*	S1=5.524*
Morocco	R_1=4.363*	R_1=5.250*	R_1=6.000*	R_1=6.557*
	R_2=3.802*	R_2=4.595*	R_2=4.956*	R_2= 5.397 *
	S_1=3.109*	S_1=4.565*	S_1=4.977*	S_1=4.895*
South Africa	R_1=0.812	R_1=0.474	R_1=0.532	R_1=0.361
	R_2=0.163	R_2= 0.304	R_2=0.550	R_2= 0.325
	S_1=1.242	S_1=1.005	S_1=0.970	S_1=1.636
India	R_1=2.312	R_1=3.227 *	R_1=2.838*	R_1=2.875*
	R_2= 1.822	R_2= 2.841*	R_2=2.459**	R_2=2.484**
	S_1=3.324*	S_1=4.253*	S_1=3.328*	S_1=3.526*
China	R_1=0.716	R_1=2.040**	R_1=2.787 *	R_1=2.679*
	R_2= -0.061	R_2= 1.643	R_2=2.493**	R_2=2.304**
	S_1=1.981**	S_1=2.081**	S_1=2.508**	S_1=2.704*
Indonesia	R_1=0.860	R_1=2.925 *	R_1=3.698*	R_1=2.886 *
	R_2= 0.171	R_2=2.396*	R_2=3.486*	R_2=2.490**
	S_1=1.397	S_1=2.647*	S_1=2.973*	S_1=2.733*
Country	**Panel B- Monthly Returns**			
	Holding Period			
	q=2	q=4	q=8	q=16
Egypt	R_1=2.815*	R_1=3.800*	R_1=4.764*	R_1=4.134*
	R_2=3.220*	R_2=4.120*	R_2=4.887*	R_2=4.236*
	S_1=1.639	S_1=2.629*	S_1=3.023*	S_1=2.650**
Morocco	R_1=1.478	R_1=2.955*	R_1=3.975*	R_1=5.087*
	R_2= 0.872	R_2=2.208**	R_2=3.116*	R_2=4.055*
	S_1=3.428*	S_1=4.502*	S_1=5.820*	S_1=7.302*
South Africa	R_1=-0.233	R_1=-0.639	R_1=-1.170	R_1=-1.069
	R_2=-0.308	R_2=-0.618	R_2=-1.096	R_2=-1.122
	S_1=0.631	S_1=-0.187	S_1=-0.237	S_1=-0.223
India	R_1=1.228	R_1=1.470	R_1=1.116	R_1=0.355
	R_2=1.615	R_2=1.647	R_2=1.250	R_2=-0.018
	S_1=-0.210	S_1=0.712	S_1=1.269	S_1=1.518
China	R_1=2.526*	R_1=2.232**	R_1=1.147	R_1=0.974
	R_2=2.087**	R_2=1.939**	R_2=0.896	R_2=0.519
	S_1=2.456**	S_1=2.138**	S_1=1.376	S_1=1.953
Indonesia	R_1=1.726	R_1=0.855	R_1=0.741	R_1=-0.324
	R_2=1.888**	R_2=0.751	R_2=0.687	R_2=-0.684
	S_1=1.589	S_1=0.991	S_1=0.671	S_1=0.308

**, ** indicate significance at 1% and 5% respectively.*

Table (5): Multiple VR Results for Weekly and Monthly Returns (Local currencies)

Country	Panel A: Weekly Returns No. of Obs.	JS_1 q=(2,4,8,16)	MVR_2 *m*=4	${MVR_2}^*$ p-values from Wild Bootstrap
Egypt	783	5.524*	4.115*	0.0006*
Morocco	783	4.977*	3.136*	0.005*
South Africa	887	1.636	0.4482	0.9448
India	887	4.253*	2.168	0.0632***
China	887	2.704**	1.845	0.1462
Indonesia	992	2.973*	1.545	0.239
Index	**Panel B: Monthly Returns No. of Obs.**	**JS_1 q=(2,4,8,16)**	**MVR_2 q=(2,4,8,16)**	**${MVR_2}^*$ p-values from Wild Bootstrap**
Egypt	180	3.023*	4.183*	0.0002*
Morocco	180	7.302*	2.776**	0.0084*
South Africa	203	0.631	0.8038	0.8352
India	203	1.518	1.676	0.1918
China	203	2.456**	1.056	0.5336
Indonesia	228	1.589	1.560	0.2028

Based on 5000 Monte Carlo trials for q=(2,4,8,16), the critical values of JS_1 test statistic for sample size of 783 are 2.900 (1%),2.325 (5%); when sample size is 887; 2.854 (1%),2.279 (5%) when sample size is 992, 2.919 (1%), 2.291 (5%) when sample size is 180; 2.929 (1%), 2.236 (5%) when sample size is 203; 3.018 (1%), 2.288 (5%) when sample size is 228; 2.921 (1%),2.265 (5%) . The critical values for CHODE (MV) test are 3.022(1%), 2.491(5%), and 2.226(10%).,** indicate significance at 1% and 5% respectively.*

Table (6): Variance Ratio Tests for Intervals 2, 4, 8, and 16 on Weekly Returns (US dollar)

Index	Egypt	Morocco	South Africa	India	China	Indonesia
No of obs.	783	783	887	887	887	992
q = 2	VR(q)= 1.102	VR(q)= 1.079	VR(q)=0.993	VR(q)= 1.053	VR(q)= 0.985	VR(q)= 0.9154
	$M_1(q)$= 2.768* [√]	$M_1(q)$=2.064** [×]	$M_1(q)$= -0.277	$M_1(q)$=2.060** [×]	$M_1(q)$= -0.513	$M_1(q)$=-2.723* [√]
	$M_2(q)$=2.055 ** [×]	$M_2(q)$= 1.464	$M_2(q)$= -0.149	$M_2(q)$= 1.635	$M_2(q)$= -0.400	$M_2(q)$=-1.030
q = 4	VR(q)= 1.267	VR(q)= 1.227	VR(q)=1.0348	VR(q)=1.178	VR(q)= 1.098	VR(q)= 1.065
	$M_1(q)$= 3.850* [√]	$M_1(q)$= 3.195* [√]	$M_1(q)$=0.443	$M_1(q)$= 3.157* [√]	$M_1(q)$=1.447	$M_1(q)$=0.984
	$M_2(q)$=2.770* [√]	$M_2(q)$= 2.265** [×]	$M_2(q)$=0.249	$M_2(q)$=2.452** [×]	$M_2(q)$= 1.161	$M_2(q)$=0.369
q = 8	VR(q)= 1.558	VR(q)= 1.379	VR(q) =1.095	VR(q) =1.255	VR(q)= 1.245	VR(q)= 1.276
	$M_1(q)$= 5.019* [√]	$M_1(q)$= 3.317* [√]	$M_1(q)$= 0.786	$M_1(q)$=3.037* [√]	$M_1(q)$= 2.270** [×]	$M_1(q)$=2.750* [√]
	$M_2(q)$=3.567* [√]	$M_2(q)$= 2.362** [×]	$M_2(q)$=0.457	$M_2(q)$=2.389** [×]	$M_2(q)$= 1.837	$M_2(q)$=1.068
q = 16	VR(q)=2.057	VR(q)= 1.630	VR(q) = 1.078	VR(q)=1.391	VR(q)= 1.363	VR(q)=1.338
	$M_1(q)$= 6.223* [√]	$M_1(q)$= 3.573* [√]	$M_1(q)$= 0.281	$M_1(q)$=3.137* [√]	$M_1(q)$= 2.143** [×]	$_1(q)$= 2.128** [×]
	$M_2(q)$=4.532* [√]	$M_2(q)$= 2.640* [√]	$M_2(q)$=0.174	$M_2(q)$=2.539** [√]	$M_2(q)$=1.772	$M_2(q)$=0.922

,indicate significance at 1% and 5% when compared with critical values of 2.576 and 1.96 (of the standard normal distribution) respectively. The symbol [√] indicates that the VR is statistically different from unity at the 5% level of significance when compared with the SMM critical value of 2.491. The symbol [×] indicates an inferential error in which the variance ratios are separately statistically different from unity according to the standard normal distribution critical values, however; they are insignificant compared with the SMM distribution critical values.*

For the aforementioned countries, VRs exceed unity which implies the existence of positive serial correlation amongst return series. On the other hand, according to the test statistic robust for heteroskedasticity M2(q), the remaining markets are said to be efficient in pricing securities as the null hypothesis of RWH has to be accepted . According to Table (7), VRs are found to be significantly greater than unity for all holding periods, whether M1(q) or M2(q) is used, for Egypt. In contrast, according to the test statistic robust for heteroskedasticity M2(q), all other markets are found to be efficient in pricing equities as the null hypothesis of obeying random walk has to be accepted except for Morocco in intervals

8 and 16 and India in intervals 2 and 4. For Tables (6) and (7), the calculated test statistics are compared with the SMM distribution critical value of 2.491 (corresponding to a 5% level and m=4). This comparison highlights inferential errors, as shown before in Tables (1) and (2), due to using the single VR tests and ignoring the joint nature of the VR approach to testing the RWH. Generally speaking, for weekly returns, the Egyptian, Moroccan, and Indian exchanges violate the RWH according to both single and multiple VR tests, as the null has to be rejected whether critical values of normal distribution or those of SMM distribution are used. Disobedience of the RWH, according to both single and multiple VR tests, has been only confirmed for the Egyptian and Moroccan exchanges.

Table (7): Variance Ratio Tests for Intervals 2, 4,8 and 16 on Monthly Returns: (US dollar)

Index	**Egypt**	**Morocco**	**South Africa**	**India**	**China**	**Indonesia**
No of obs.	**180**	**180**	**203**	**203**	**203**	**228**
q = 2	VR(q)= 1.307	VR(q)= 1.069	VR(q)= 1.037	VR(q)= 1.184	VR(q)= 1.115	VR(q)= 1.229
	$M_1(q)$= 3.934* [√]	$M_1(q)$=0.724	$M_1(q)$= 0.384	$M_1(q)$= 2.453** [×]	$M_1(q)$= 1.479	$M_1(q)$=3.301* [√]
	$M_2(q)$=2.966 * [√]	$M_2(q)$=0.580	$M_2(q)$=0.315	$M_2(q)$= 2.037** [×]	$M_2(q)$= 1.061	$M_2(q)$=2.138** [×]
q = 4	VR(q)= 1.715	VR(q)= 1.284	VR(q)=1.029	VR(q)= 1.329	VR(q)= 1.217	VR(q)= 1.282
	$M_1(q)$= 4.719* [√]	$M_1(q)$= 1.728	$M_1(q)$=-0.007	$M_1(q)$= 2.204** [×]	$M_1(q)$= 1.378	$M_1(q)$=2.008** [×]
	$M_2(q)$=3.818* [√]	$M_2(q)$=1.447	$M_2(q)$= -0.006	$M_2(q)$= 1.955** [×]	$M_2(q)$=1.042	$M_2(q)$=1.362
q = 8	VR(q)= 2.380	VR(q)= 1.624	VR(q)= 0.946	VR(q)= 1.528	VR(q)= 1.146	VR(q)= 1.586
	$M_1(q)$=5.435* [√]	$M_1(q)$= 2.265** [√]	$M_1(q)$=-0.565	$M_1(q)$= 2.042** [×]	$M_1(q)$= 0.327	$M_1(q)$=2.499** [√]
	$M_2(q)$=4.624* [√]	$M_2(q)$= 1.949** [√]	$M_2(q)$= -0.450	$M_2(q)$=1.850	$M_2(q)$=0.259	$M_2(q)$= 1.729
q = 16	VR(q)= 2.937	VR(q)= 2.242	VR(q)= 0.907	VR(q)= 1.366	VR(q)= 1.182	VR(q)= 1.586
	$M_1(q)$= 4.470* [√]	$M_1(q)$= 2.690* [√]	$M_1(q)$= -0.720	$M_1(q)$= 0.551	$M_1(q)$= 0.042	$M_1(q)$= 1.316
	$M_2(q)$=4.075* [√]	$M_2(q)$=2.480** [×]	$M_2(q)$= -0.617	$M_2(q)$=0.498	$M_2(q)$=0.034	$M_2(q)$= 0.927

**, ** indicate significance at 1% and 5% when compared with critical values of 2.576 and 1.96 (of the standard normal distribution) respectively. The symbol [√] indicates that the VR is statistically different from unity at the 5% level of significance when compared with the SMM critical value of 2.491. The symbol [×] indicates an inferential error in which the variance ratio is separately statistically different from unity according to the standard normal distribution critical values, however; it is insignificant compared with the SMM distribution critical values.*

Results of VR tests, based on the methodology of Wright (2000), for weekly and monthly returns of employed indexes, when returns are denominated in US dollar currencies, exhibits that statistics do agree in rejecting the null of RWH for all holding periods for weekly and monthly returns of Egypt and for weekly returns of Morocco and India. The observed test statistics are greater than their corresponding critical values obtained from Monte Carlo simulation reported in Table 2. Evidence is omitted for reasons of space. All rejections are in the right tail of the distribution implying that return series of these countries are positively serially correlated. On the other hand, the aforementioned test statistics agree that weekly and monthly returns of South Africa obey the RWH. For other countries, mixed results have been found as rejections of the null vary according to frequency of data and holding periods.

Results of multiple variance ratios for weekly and monthly returns of employed indexes are shown in Table (8). For weekly returns, the calculated test statistic of JS1 are found to significantly larger than their corresponding critical values, obtained from Monte Carlo simulation and reported beneath Table (8), for all countries except for India. Thus, all markets are not in conformity with the RWH according to JS1. According to MVR_2 and MVR_2*, the null of RWH is to be rejected for four countries (Egypt, Morocco, India, and China) and for three countries (Egypt, Morocco, and India) respectively, when weekly data is employed. For monthly data, the three multiple tests agree in rejecting the null for the Egyptian and

Moroccan exchanges. For the other markets, the null is to be rejected by only one test (e.g. it has to be rejected for China when JS1 test is used and for India when the wild bootstrap of MVR2 is used).

Table (8): Multiple VR Results for Weekly and Monthly Returns (US dollar)

Country	Panel A: Weekly Returns			
	No. of Obs.	JS_1 q=(2,4,8,16)	MVR_2 m=4	MVR_2^* p-values from Wild Bootstrap
Egypt	783	5.788*	4.532*	0.0002*
Morocco	783	5.163*	2.640**	0.0168**
South Africa	887	2.480**	0.4573	0.9138
India	887	4.074*	2.539**	0.026**
China	887	1.837	2.437***	0.148
Indonesia	992	4.722*	1.068	0.5142
Index	**Panel B: Monthly Returns**			
	No. of Obs.	**JS_1 q=(2,4,8,16)**	**MVR_2 q=(2,4,8,16)**	**MVR_2^* p-values from Wild Bootstrap**
Egypt	180	3.678*	4.624*	0.000*
Morocco	180	2.950*	2.480***	0.0186**
South Africa	203	1.725	0.6173	0.963
India	203	0.7128	2.037	0.0828***
China	203	2.73**	1.061	0.5282
Indonesia	228	1.854	2.138	0.054***

Based on 5000 Monte Carlo trials for q=(2,4,8,16), the critical values of JS_1 test statistic for sample size of 783 are 2.900 (1%),2.325 (5%); when sample size is 887; 2.854 (1%), 2.279 (5%) when sample size is 992, 2.919 (1%), 2.291 (5%) when sample size is 180; 2.929 (1%), 2.236 (5%) when sample size is 203; 3.018 (1%), 2.288 (5%) when sample size is 228; 2.921 (1%),2.265 (5%) . The critical values for CHODE (MV) test are 3.022(1%), 2.491(5%), and 2.226(10%).,**,*** indicate significance at 1%, 5%, and 10% respectively.*

CONCLUSION

This paper is trying to examine the efficiency in emerging stock markets, and the impact on the foreign investment opportunities in these markets, concluding the ability of these markets to face the global competition and improving their performance. Based on the goal of the paper it is required using different econometrical methods focusing on the recent ones. Particularly we run Single variance ratio test of Lo and Mackinlay (1988), multiple variance tests of Chow and Denning (1993), individual variance test based on ranks and signs of Wright (2000), Wild bootstrap test of Chow and Denning introduced by Kim (2006), and joint version of sign test of Wright by Kim and Shamsuddin (2008). It is worth to mention that the methodology used in this paper considered as the recent and the most used in the recent papers regarding to this topic. Our datasets contain stock market data from different emerging markets, namely: Egypt.

Morocco, South Africa, India, China and Indonesia. The empirical analysis came out with some results could be concluded as the following: the efficiency of the stock market varies with the level of institutionally mature which leads to equity market development. Accordingly, the Egyptian, Moroccan and Indian exchanges are not in conformity with the RWH from the perspective of both local and international investors when weekly returns are employed. More the first two markets are considered inefficient in pricing equities, from the perspective of both local and international investors, when monthly returns are employed. The Indian market supports that testing for RWH is sensitive to the frequency of data used. It is worth mentioning that empirical results obtained from employing multiple variance ratio tests demonstrate insensitivity of testing of RWH to exchange rate changes. So we document that exchange rates matter in the determination of emerging markets' stock returns' dynamics. Investing in countries that have a history of marked exchange rate regime instability, yielded different equity return dynamics for international and local investors. Finally, this paper could be the initial of series of research focusing on the emerging stock markets especially in Asia and Africa and the possibility of the integration between those markets as they considered as the lowest influenced markets by the global financial crisis which make them the right markets to invest especially after integration.

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