TESTING WEAK FORM STOCK MARKET EFFICIENCY ON MUSCAT SECURITIES MARKET: OMAN

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Abstract:

This paper examines the random walk behavior of daily and weekly returns of the MSM 30 index, the leading index of Muscat Securities Market during 1st July 2010 to 30th June, 2013. MSM-30 Index is tested for weak form efficiency using unit root tests like Augmented Dickey-Fuller test, Phillips-Peron (PP) test, Kwiatkowski, Phillips, Schmidt and Shin (KPSS), and Variance ratio test using homoscedastic and heteroscedastic test estimates. Results of all the unit root tests are consistent and support the presence of unit root. Variance ratio test supports that Muscat stock market index do not follow random walk and autocorrelation is a cause of non-random nature not heteroscedasticity. Since variance ratio test is more powerful than unit root tests performed in the study, author goes by the results of variance ratio test.

Keywords: *Random walk, Unit root, Variance ratios, market efficiency*

Introduction

The term market efficiency in capital market theory is used to explain the degree to which stock prices reflect all available, relevant information. The Efficient Market Hypothesis (EMH) proposed by Fama (1970) defines an efficient market as one in which new information is quickly and correctly reflected in its current stock price. In his paper, Fama (1970) formalized the theory and presented empirical evidences, he also subdivided the EMH into the weak-form, semi-strong-form and strong-form. This paper focuses on the weak-form version, which asserts that security prices fully reflect all historical information.

The logic behind the random walk concept is that price changes occur only in response to genuinely new information. Since genuine news is by definition unpredictable, the resulting price changes must be unpredictable and random. The weak-form of EMH asserts that stock prices already reflect all information that can be derived by exploring market trading data such as the history of past prices, trading volume and any other market oriented information. The semi-strong-form hypothesis states that all publicly available information regarding the prospects of a firm already must be reflected in the stock price. Information related to company fundamentals, management expertise, accounting practices and decisions like dividends and stock splits are reflected in the stock price. Finally the strong-form EMH contends that stock prices reflects all information from historical, public, and private sources, so that no investor can realize abnormal rate of return. Stock market efficiency is an important concept, both in terms of an understanding of the working of stock markets and in their performance and contribution of the development of a country's economy. If the stock market is efficient, the prices will represent the intrinsic values of the stocks or in other words, stocks will reflect their true value leading to optimum allocation of resources that benefits both individual investors and country as a whole. The efficient market hypothesis implies that technical analysis is without merit. The past history of prices and trading volume is publicly available at minimal cost. Therefore, any publicly available information would be reflected in stock prices. The key to successful technical analysis is a sluggish response of stock prices or in other words inefficiency of the market. This is because if the stock price responds slowly enough to the publicly available information, the intelligent investor will be able to identify a trend that can be exploited to get abnormal returns. Therefore, if EMH holds investors should doubt the strategy of beating the market and should adopt the strategy of buy and hold.

The objective of this paper is to investigate weak-form efficient market hypothesis in the Muscat securities market (MSM). The presence of random walk is evaluated using stock market index, MSM-30. The stock index is tested for random walk using two procedures i.e. Unit root test and Variance ratio test. The three different unit root tests Augmented Dickey-Fuller (ADF) test, the Phillips-Peron (PP) test, and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test are applied to test the presence of unit root. Later on , as a confirmatory test more powerful Variance ratio test as suggested by Lo & MacKinlay in 1988 is used to test randomness in the MSM-30 index.

Literature Review

There is wide literature available on random walk hypothesis and stock market efficiency. The random walk model was first developed by Bachelier (1900) in which he confirmed that price changes are nearly uncorrelated resulting to a random-walk like behavior or random nature of price changes. Samuelson (1965) and Fama (1965, 1970) triggered keen interest in this area. Samuelson (1965), Fama (1965) and Jennergeen and Korsvold (1974) examined the behavior of stock returns by applying serial correlation tests and they found markets as efficient.

Poshakwale (1996) examined on weak form efficiency in Bombay Stock Exchange by using serial correlation and runs test on the selected data. He concluded that market is not weak form efficient. Alam et al. (1999) tested the random walk hypothesis for Bangladesh, Sri Lanka, Hong Kong and Taiwan. They discovered that except Sri Lankan all other stock indices follow a random walk. Mobarek & Keasey (2000) in their study on Dhaka Stock exchange applied Runs test, Smirnov normality test, Auto-correlation, Auto-regression, and ARIMA on daily price indices, empirical results revealed that Dhaka stock exchange is not weak form efficient.

Worthington & Higgs (2006) studied daily stock returns of emerging markets like China, India, Korea, Malaysia, Pakistan, Sri Lanka, Indonesia, Philippines, Thailand and Taiwan and five developed stock markets of Australia, Japan, Hong Kong, Singapore and New Zealand. They used various tests like Augmented Dickey fuller test, Phillips-Perron test, Runs test, multiple variance ratio tests and auto correlation function test. Among these Runs test, multiple variance ratio tests and Auto-correlation test confirmed that all the emerging markets and three developed markets of Japan, New Zealand and Hong Kong are not weak-form efficient.

Pan et al. (1991) analyzed the weak form of efficiency in five Asian stock markets of Hong Kong, Singapore, Japan, Taiwan and South Korea using Variance ratio test on daily and weekly returns. Authors concluded that only Japan is weak form efficient on both daily and weekly returns whereas Singapore and Korea are not weak form efficient for both the weekly and daily returns. Hong Kong daily returns and Taiwan weekly returns were also not weak form efficient. Chakraborty (2006) in his study analyzed the weak-form efficiency of the Pakistani stock market by considering daily closing prices and used serial correlation and variance ratio test in his study; he revealed that the stock market is inefficient.

Since majority of Arab stock market are emerging markets, therefore abundant literature is available on Arab stock markets. Dahel and Laabas (1999) observed the behavior of the daily stock prices in the Gulf countries Bahrain, Kuwait, Saudi Arabia and Oman. They observed that except Kuwait Stock Market other markets are not weak form efficient market. Abraham et al (2002) applied Lo and MacKinlay variance ratio test on emerging markets and observed dependencies in returns at index values for Saudi Arabia, Kuwait and Bahrain.

Smith (2007) studied the weak form of efficiency in the Middle East stock markets and found that Israeli, Lebanese and Jordanian markets were weak-form efficient while the Kuwait and Oman markets were not. Al Khzali et al (2007) who studied the behavior of Saudi Arabia, Bahrain and Kuwait concluded that Saudi Arabia and Bahrain stock market strongly support random walk while Kuwait fails within the critical bounds.

Marashdeh and Shrestha (2008) examined the randomness of stock price index in UAE by using unit root test of Augmented Dickey Fuller and Philip-Perron. The results show that the data has a unit root and follows a random walk. Benjelloun and Squalli (2008) studied the markets of UAE, Jordan, Saudi Arabia and Qatar and revealed that results are not consistent across different sectors and markets. Randomness was rejected in general indexes of Jordan, Abu Dhabi and Dubai. However, in case of sectoral indexes, they failed to reject the randomness in few sectors. Al-Jafari (2012) tested day-of-the-week effect on Muscat securities market using MSM 30 index and observed that day-of-the-week effect is not present and MSM is an efficient stock market.

There is extensive literature on random walk and market efficiency still there is lack of consensus among the researchers regarding efficiency of GCC markets. Compared to the countries like Saudi Arabia, Jordan and Kuwait lesser literature is available on Oman stock market and there is lack of clarity regarding the weak form efficiency of MSM. Therefore, this study attempts to fill the gap in literature and to provide recent empirical evidence on stock market efficiency of Muscat Securities Market.

Overview of Muscat Securities Market

The Muscat Securities Market (MSM) is the only stock exchange in Oman. It was established on 21 June 1988, to regulate and control the securities market of Oman. Ten years later some reforms were realized and Capital Market Authority (CMA) was established as a separate regulatory body responsible for organizing and supervising the issue and trading of securities in the Sultanate. After commencement of CMA the regulatory and exchange functions of the stock exchange were separated with executing body as MSM and regulating body as CMA.

MSM has two classifications, one is regular market and other one is parallel market. Regular market has strict norms and only financially sound company can be listed on regular market. Whereas, listing norms for parallel markets are relatively relaxed and this makes weak and new companies to list on parallel market.

Performance Snapshot

Table I reflects the key stock market indicators of MSM from year 2008 to 2012.The MSM 30 index closed at the end of year 2012 at 5,760.84 recording increase of 65.7 points representing 1.15% compared with the last year. The Market capitalization increased by 12.79% compare with last year, reaching around Omani rial(OMR) 11.67 billion in year 2012.Trading value of 2012 reached OMR 1.07 billion with daily average OMR 4.28 million, recording increase of 7.49% compare with last year. The market capitalization to GDP ratio, which is indicative of the market size, marginally increased to 38.8 % in 2012 from 38.4% in the previous year.

Table I: Key Stock Market Indicators

Indicator	2008*	2009*	2010	2011	2012
MSM 30 Share Price Index	5441.12	6368.80	6754.92	5695.12	5760.84
Number of shares traded(Mil)	4198.4	6067.4	3013.2	2366.2	4319.2
Number of bonds traded(Mil)	6.3	23.9	11.3	14.1	23.0
Total turnover (RO Mil)	3388	2285	1317	991	1065
a) turnover in shares (RO Mil)	3346	2246	1274	981	1025
b) turnover in bonds (RO Mil)	42	39	43	10	40
Number of trading days	248	246	247	246	249
Average trading per day in shares and bonds(RO Mil)	13.66	9.29	5.33	4.03	4.28
Market Capitalization (RO Mil)	7912	9093	10902	10342	11665
*Figures for 2008 & 2009 do not include OTC trading					

Source: Annual Report 2012, Central Bank of Oman

Data and Methodology

This paper uses the MSM-30 index to analyze the weak form of efficiency in the Muscat securities market. The study spans more than three years, starting from 1st July 2010 and extending till 30th June, 2013 for daily & weekly returns. The return is calculated as the logarithmic difference between two consecutive prices in a series, yielding continuously compounded returns.

The MSM Index (MSM-30) was established in 1992 with a base year of June 1990 and base value of 1000. It serves as a benchmark to investors in tracking the performance of the Omani stock market. It is a value-weighted index of 30 high capitalized most liquid and profitable companies that are listed on MSM. Index includes 30 companies selected on the basis of market capitalization (weight 40%), liquidity (weight 45%) and earnings per share (weight 15%). The components of MSM-30 index are revised every year on the basis of performance and index components are changed every year in the month of July.

The Muscat Securities Market Index, MSM 30, is a capitalization-weighted index of the 30 most highly capitalized, liquid and profitable companies listed on the Muscat Securities Market. The main objective of the MSM 30 is to represent all the stocks listed in the exchange and to work as a benchmark index for the investors. To achieve these objectives, the MSM 30 has the following features:

1. Only freely floating shares for trading are included in the construction of the index. Therefore, other shares like shares held by the government, promoters, strategic holdings and locked-in shares which are not tradable for at least 3 months are excluded.

2. To ensure wider representation of smaller companies a 10% capping (CAP) is set in the index.

3. The free float stocks and capping is revised on a quarterly basis, by end of March, June, September and December. But the index sample amendment takes place in the beginning of July each year.

The MSM-30 includes three main sectors namely banking and investment, industry, and services and insurance. In MSM -30 for year 2011-2012 out of the total 30 index constituents, Banking and investment sector continues to dominate with a total of 13 companies, A total of 11 companies from the Industry sector and about 6 companies in the Services sector. The break-up of market capitalization for MSM-30 for year 2011-2012 is 53% for Banking and Investment sector, 32.5% for Services & Insurance sector and 14.5% for Industry sector.

Unit Root Test

A unit root test tests whether a time series variable is non–stationary using an autoregressive model. Three different unit root tests are used to test the presence of a unit root in a series: namely, the Augmented Dickey-Fuller (ADF) test, the Phillips-Peron (PP) test, and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test. Dickey-Fuller test involves fitting the regression model as:

$\mathbf{P_t = \phi P_{t-1} + u_t}$ where Pt denotes the price at time t

Test examines the null hypothesis that series contains the unit root versus series is stationary.

$H_0: \varphi = 1$

$H_1: \varphi < 1$

The null hypothesis of a unit root is rejected in each case if the test statistic is more negative than the critical value. A series with unit root is said to be non-stationary and follow random walk. But in this serial correlation creates problem, to counter this Augmented Dickey Fuller test (ADF) equation includes lags of the first differences of Pt.

The ADF unit root test is conducted using the following regression equation:

$$\Delta P_{it} = \beta_0 + \beta_1 t + \phi_0 P_{it-1} + \sum \phi_i \Delta P_{it-i} + \varepsilon_{it} \qquad (1)$$

In equation (1), ΔP_{it} is the first difference term i.e. (P_{it} - P_{it-1}), ε_{it} it is the white noise or error term, β_0 is the constant, β_1 is the coefficient for the trend and φ_i i are coefficients to be estimated.

One advantage of the PP tests over the ADF tests is that the PP tests are robust to serial correlations and general forms of heteroskedasticity in the error term ut. Another advantage is that the user does not have to specify a lag length for the test regression. KPSS test also uses autocorrelation correction approach like PP test but in KPSS parametric approach is adopted to overcome the problem of autocorrelation. In KPSS the null hypothesis is different from the earlier two tests as it assumes stationarity of the variable and the alternative is the presence of unit root or non-stationarity of the variable or presence of random walk. To increase the robustness of the result all the three tests are used to detect unit root in the series.

Variance Ratio Test

In this study variance ratio test developed by Lo & Mackinlay (1988) is used on the MSM-30 index to study random walk hypothesis. Variance ratio is applied after the unit root test, as the variance ratio test is more powerful and robust than unit root tests. Variance ratio test is based on the concept of random walk that if a time series of variable Pt follows a random walk then the variance of increments of Pt is linear in its data interval. This means that the variance of $(P_t - P_{t-1}) = (P_t - P_{t-n})/n$, or the variance of its n-differences is n times the variance of its first difference for a random walk series.

The null and alternative hypothesis of the test are stated as

H_0: The variance ratio at lag n, VR (n) = 1

H_1: The variance ratio at lag n, VR (n) $\neq$ 1

Where VR(n) = Var[rt(n)] /[n. Var(rt)] is the variance ratio at lag n

Due to the above relationship, Lo & Mackinlay (1988) says that the variance of weekly price changes must be five times the variance of a daily price change. As in general there are five working days in a week for the stock markets.

Findings

All the unit root tests were applied once on daily return and then on weekly return of MSM-30 index. Results of Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) tests and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test for the daily observations are presented in Table II, containing t-statistics and p-values of ADF and PP test and LM-statistic and asymptotic significance for KPSS at the level and difference series of the logarithm of prices. The null hypothesis for ADF and PP test is same; it is tested for null hypothesis of unit root against the alternative of no unit root i.e. stationary. In KPSS the null hypothesis is different from the earlier two tests as it assumes stationarity of the variable and the alternative is the presence of unit root or non-stationarity of the variable or presence of random walk. At levels, the ADF and PP t-statistics do not reject the null hypotheses of a unit root at 0.05 or lower level, i.e. unit root or non-stationary time series.

Table II: Unit root results on daily returns

Level		Difference	
ADF t- statistics	ADF p-value	ADF t- statistics	ADF p-value
-1.485875	0.5405	-23.53574	0.0000
PP t- statistics	PP p-value	PP t- statistics	PP p-value
-1.568487	0.4983	-23.87755	0.0000
KPSS t- statistics	Asymptotic critical values	KPSS t- statistics	Asymptotic critical values
1.347724	1% level- 0.739000	0.174591	1% level- 0.739000
	5% level- 0.463000		5% level- 0.463000
	10% level- 0.347000		10% level- 0.347000

For the KPSS tests of the null hypothesis of no unit root, the LM-statistic exceeds the asymptotic critical value at the .01 level at the level series, indicating these series are non-stationary. Since the ADF, PP and KPSS tests on the log of prices accepted the presence of unit roots, there is no evidence against weak form efficiency when Muscat securities market was tested on daily data.

Table III: Unit root results on weekly returns

Level		Difference	
ADF t- statistics	ADF p-value	ADF t- statistics	ADF p-value
-1.573953	0.4934	-11.67795	0.0000
PP t- statistics	PP p-value	PP t- statistics	PP p-value
-1.573953	0.4934	-11.67002	0.0000
KPSS t- statistics	Asymptotic critical values	KPSS t- statistics	Asymptotic critical values
0.552271	1% level- 0.739000	0.245666	1% level- 0.739000
	5% level- 0.463000		5% level- 0.463000
	10% level- 0.347000		10% level- 0.347000

Results for weekly returns are summarized in table III; results reveal acceptance of null hypothesis for ADF and PP unit root test at 5% or lower level i.e. series has unit root or non-stationary series. According to KPSS unit root test, series has no unit root at 1% level but at higher levels it has unit root i.e. at 5% and above series is non-stationary. Therefore on both daily and weekly returns, there is no evidence against weak form efficiency of Muscat securities market but since unit root tests have poor power properties, robust variance ratio test is also conducted.

Table IV summarizes the results of the variance ratio tests on daily and weekly returns of MSM-30 index for the given period. The sampling intervals are 2, 5, 10 and 20 days, corresponding to one-day, one week, one fortnight and one month calendar periods. For each interval only the maximum absolute values of the test statistics are examined.

Table IV: Individual and Joint Test results for Variance Ratio based on daily & weekly returns

Data Type	Statistics	q=2	q=5	q=10	q=20	Joint Test Max |z| (at period 2)
		Under Homoskedasticity				
Daily	Variance Ratio	0.551229	0.231355	0.125146	0.054104	
Daily	Z(q)-statistic	-12.34733	-9.652798	-7.129039	-5.236520	12.34733
Daily	Probability	0.0000	0.0000	0.0000	0.0000	0.0000
Data Type	**Statistics**	**q=2**	**q=5**	**q=10**	**q=20**	**Joint Test Max |z| (at period 2)**
		Under Heteroskedasticity				
Daily	Variance Ratio	0.551229	0.231355	0.125146	0.054104	
Daily	Z*(q)-statistic	-3.013568	-2.850846	-2.579530	-2.372500	3.013568
Daily	Probability	0.0000	0.0020	0.0100	0.0210	0.0100
Data Type	**Statistics**	**q=2**	**q=5**	**q=10**	**q=20**	**Joint Test Max |z| (at period 2)**
		Under Homoskedasticity				
Weekly	Variance Ratio	0.540925	0.208433	0.091159	0.047472	
Weekly	Z(q)-statistic	-5.584890	-4.395398	-3.274661	-2.331633	5.584890
Weekly	Probability	0.0000	0.0000	0.0011	0.0197	0.0000
Data Type	**Statistics**	**q=2**	**q=5**	**q=10**	**q=20**	**Joint Test Max |z| (at period 2)**
		Under Heteroskedasticity				
Weekly	Variance Ratio	0.540925	0.208433	0.091159	0.047472	
Weekly	Z*(q)-statistic	-4.375854	-3.779718	-2.998561	-2.287134	4.375854
Weekly	Probability	0.0000	0.0000	0.0010	0.0030	0.0000

1. Z(q)-test statistic for null hypothesis of homoskedastic increments random walk
2. Z*(q)-test statistic for null hypothesis of heteroskedastic increments random walk
3. q are sampling intervals in days

The null hypothesis that daily equity returns follow a homoskedastic random walk is rejected at all the values of sampling intervals(q), the highest absolute value Z(2) = -12.34733. Similarly for weekly returns the null hypothesis is rejected for all the values of q, the highest absolute value Z(2) = -5.584890. Therefore it is concluded that Muscat Securities market do not follow a random walk. Though, rejection of the null hypothesis under homoskedasticity could result from heteroskedasticity and/or autocorrelation in the return series. That is why a heteroskedastic consistent statistic is calculated and tested again, the null hypothesis is rejected at all the sampling intervals including the highest value of q, Z*(2) = -3.013568 for daily returns and Z*(2) = -4.375854 for weekly returns were also significant. The heteroskedastic random walk hypothesis is thus rejected because of autocorrelation in the daily increments of the returns on MSM-30 index. Joint test also gives the same result as it is done for the highest absolute value of sampling interval. The null hypothesis of a random walk under assumptions of both homoskedasticity and heteroskedasticity is rejected for MSM-30 index. Finally it is concluded that Muscat Securities market is not weak form efficient and results are consistent with the previous studies of Dahel & Laabas (1999) and Smith (2007).

Concluding Remarks

The rationale of this study is to explore and test the random walk and weak-form informational stock market efficiency in the Oman. To satisfy the requirement two different procedures are employed on daily and weekly returns of MSM-30 index: (i) ADF, PP and KPSS unit root tests and (ii) Variance ratio test. The findings show empirical evidence that Muscat stock index (MSM-30) exhibit unit root for both daily and weekly returns. All three unit root tests are consistent and are giving the same result that there is no evidence against weak form efficiency of Muscat securities market. In variance ratio test the rejection of null hypothesis of a random walk under assumptions of both homoskedasticity and heteroskedasticity is rejected for MSM-30 index concluding that Muscat Securities market is not weak form efficient. Therefore, it is expected that investors can generate abnormal or undue returns using past information and technical analysis which helps in identifying under-priced shares. The findings of this study will supplement existing literature on testing of random walk and weak-form market efficiency in the emerging markets, especially in GCC countries.

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