Is Pharmaceuticals Industry Efficient?

Evidence from Dhaka Stock Exchange

Md. Noman Siddikee[1] & Noor Nahar Begum[2]

[1] Assistant Professor of Finance, International Islamic University Chittagong, Bangladesh

[2] Lecturer in Finance, Bangladesh University of Professionals, Bangladesh

Correspondence: Md. Noman Siddikee, Assistant Professor of Finance, International Islamic University Chittagong, Bangladesh. E-mail: siddikeenoman@gmail.com

Abstract

This study examines the weak form market efficiency of the thirteen listed pharmaceuticals company of Dhaka Stock Exchange (DSE). We exclude the three listed pharmaceuticals company because of their newly enlistment at DSE. The data consists of the daily returns from 1st January, 2009 to 31st December, 2013. The returns of all pharmaceuticals companies are not normally distributed. Unit root test, serial correlation test and runs tests are being used for testing weak form efficiency of the individual stocks return. The findings of the runs test is completely rejecting the random walk theory for all thirteen securities whereas the augmented dickey-fuller (ADF) test are showing inverse result with its all three equations suggesting the weak form efficiency of the Pharmaceuticals stock return. The results of the Autocorrelation and Box-Ljung statistics support random walk theory for ten companies and reject it for ACI, Reckitt Benckiser and Pharma Aid. However, from the summery of findings we can agree that the Pharmaceuticals industry of Bangladesh is just becoming weak-form efficient.

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Keywords: Pharmaceuticals industry, Random walk hypothesis, Runs test, Autocorrelation test

1. Introduction

Pharmaceuticals industry of Bangladesh is contributing significantly to accelerate the economic development of the country. It's the most attractive sector for investors because of its wide market, profit potentiality and low risk attributes. Before 1980's, this sector was not promising but after the promulgation of Drug Control Ordinance-1982, it's started escalating and now it becomes a leading hi-tech investment sector of the country. At present, this industry are exporting product to the international markets including European Union after satisfying 95% of the local demands. There are 267 pharmaceuticals company in Bangladesh in 2014, Ahmed (2014) and among them only 16 companies are listed in the Dhaka Stock Exchange (DSE). Apart from the huge technological development, government support and profit potentiality maximum pharmaceuticals company doesn't wish to be enlisted in DSE because of its high volatile characteristics. Several studies suggest that DSE is not even a weak form efficient capital market, Mollik and Bepari (2009), Mobarek and Keasey (2000). Investing in this market seems to be gambling. So before investing in any stock of this market, it's quite necessary to confirm the weak form market efficiency of particular stocks. The efficient market debate was started in 1960's when few market researcher like, Bachelier and Cootner (1964), Fama (1965,1970) argued that if the market is not efficient it could become a money machine for the investors for gaining unlimited profit. Stock return efficiency analyses are of two types, Fundamental analysis and Technical analysis. The former asserts that except historical price there are significant factors to forecast future. The later examine the presence of predictability in the historical price and establish a technical trading rule for abnormal gain analyzing past price. In our study, we try to search the predictability of future price based on historical price of the listed Pharmaceuticals companies in DSE.

2. Rationale of the study

An extensive number of researches have been conducted for testing weak form market efficiency from last century to the first decade of the current century also. Till today it continues as a core debating issues to the financial market researcher, investors, policy makers, government and its various regulatory bodies. Usually all those research have

been conducted using the stock index values to represent the entire market efficiency. But in many underdeveloped and developing countries, where weak form market efficiency is almost absent empirically, may have some stocks traded efficiently which needs to identify for the real investor's. Stock price of those securities are efficient indicates the reflection of available information to the stock price at any given time so that no investor could get advantage by trading such a stock, Fama (1970). Price efficiency mainly refers informational efficiency of the securities. However, depending on the degree of price efficiency it is three types, weak form price efficiency, semi-strong form price efficiency and strong form price efficiency. Weak form price efficiency claims that present price reflects all historical information and no technical analysis is convenient for abnormal gain. Semi-strong form price efficiency signifies that along with the historical information all public information reflects to the security price so that both fundamental and technical analysis cannot help investor's to add extra value. Strong-form efficiency is the strongest benchmark of price efficiency, where all sorts of information, like public, private and insider information reflects to the share price instantly and unbiased. Since the Pharmaceuticals industry is the leading success history of Bangladesh, different types of investors tries to know which stock can satisfy them. In this study we concentrate to examine the individual stock price efficiency of the thirteen listed pharmaceuticals companies of DSE. We are expecting that this study would contribute for further study to examine the individual stock price efficiency in future.

3. Literature Review

In the early period of market efficiency check, macro factors were the significant issues for the researcher but Fama (1991) has extended the theory to predict the security return on the basis of firm's specific factors in addition to his earlier statements of 1970's. According to his extended theory, a security price is hardly random because firm's specific factors have certain impacts on share price which is usually predictable. So even after adjustment of historical information to the share price, one can predict future price based on companies various performance indicator. Empirical findings of the several literatures reject the hypothesis of weak form market efficiency of different markets indicating an underlying relationship of present prices with the past price. For detecting such relationship, most of the authors mainly used runs test, serial correlation test, unit root test and variance ratio test in this regards. More specifically runs test have been widely used by a number of authors, Gimba, K.V (2012), Nisar and Hanif (2012), Mollik and Bepari (2009), Mobarek and Keasey (2007), Moustafa.A.M (2004), Ajao and Osayuwu (2012). In a recent study Kirkulak and Ezzat (2014) finds that market efficiency is more in developed countries rather than emerging markets. Findings of their study also support that countries which are continuing economic development, holds at least weak form market efficiency whereas low emerging markets are not. Using parametric and non-parametric tests Mobarek and Keasey (2007), finds that securities return of Dhaka Stock Exchange is not weak form efficient which is similar to Nisar & Hanif (2012) who examined four major stocks of South Asia (Bangladesh, India, Pakistan & Srilanka) and conclude that none of the market is weak form efficient. A Heteroscedasticity-robust test conducted by Islam and Khaled (2005) using the daily, weekly and monthly data from January,1990 to November, 2001 confirm the existence of short term price predictability prior to the huge market crash in 1996 and weak form market efficiency after 1996 onwards. But the findings of Mollik and Bepari (2009) are completely contradictory with Islam and Khaled (2005) who employ both parametric and non-parametric test to the daily return of the DSE General Index (DSE-GEN) and DSE 20 index from January1, 2002 to December, 31, 2007. Findings reject the weak form market efficiency of DSE during that period. Observing unusual positive growth in the Nigerian capital market in respect of market capitalization, the value of the stock, volume of trade and listing of membership from 1993 to 2007, Gimba (2012) examined the daily and weekly return of the Nigerian stock exchange index with five major individual stocks of those markets. Findings suggest that the Nigerian stock exchange is not weak form efficient which is also contradictory with the findings of Ajao and Osayuwu (2012) who conclude that Nigerian stock exchange follow random walk. Examining the 43 individual stock prices of UAE markets, Moustafa (2004) finds those 40 stocks of UAE stock markets follows random walk support the EMH of UAE stock market. However, the UAE market was small and thin in that time and trading was infrequent for most of the stocks. Steps had been taken for improving operating and price efficiency of those markets and authors had advised for further study in this regards.

4. Data & Methodology

There are sixteen listed pharmaceuticals company in Dhaka Stock Exchange (DSE). Among them we have select thirteen Pharmaceuticals Company. We discard the three listed companies because of their newly enlistment in DSE. They have enlisted in DSE within one and half years from now which is not enough time to adjust with the capital market movement. We select only those companies which are trading more than five years and had experienced the huge market crash of 2011. The daily stock price ranging from 2008 to 2013 of the thirteen listed pharmaceuticals

companies including ACI formulations, ACI, Glaxo, Ambee, Beacon, Beximco, Libra infusions, Orion infusions, Pharma Aid, Reckitt Benckiser, , Reneta, Square and Ibne-sina pharmaceuticals are being taken for this study. To examine the stock price efficiency of the pharmaceuticals company, we mainly use the market return of the above price series. Market returns are calculated as follows.

Where,

$$R_t = \ ln \frac{p_t}{p_{t-1}}$$

Where, $p_t = current\ market\ price$

$and \quad p_{t-1} = previous\ day's\ market\ price.$

5. Descriptive statistics and normality test

Descriptive statistics such as mean, median, standard deviation and variance of stock returns are calculated. To test the normality of return, we calculate the Jarque-Bera statistics, skewness, kurtosis and their z values. If the skewness value is around zero and the kurtosis value is around three we can say the return is normally or approximately normally distributed. To confirm more precisely the normality of return, we calculate the z value of skewness and kurtosis further by dividing them with their standard error. If the z value of skewness and kurtosis falls in between ±1.96, we call the return series is normally distributed.

5.1 Autocorrelation and Ljung-Box Statistics

The autocorrelation is being used to search the relationship of stock return with its own value in different lags. If the stock return follows a random walk, its autocorrelation will be zero at any lags. If it's negative it has a reverse trend in predicting future values and if it's positive the stock return is not random at all. A Ljung-Box test statistics is also used to test the overall randomness of stock return through examining the group autocorrelation of different lags is different from zero or not.

If Q $> X^2_{1-a,h}$ the return series is not random.

Where, Q = n (n+2) $\sum_{k=1}^{h} \frac{\hat{\rho}^2_k}{n-k}$

5.2 Augmented dickey fuller (ADF) test

After normality test we have conducted the augmented dickey fuller (ADF) test to conform stationary or no unit root of the log return as a necessary requirement of the Random walk theory using the following formulas.

$\Delta Y_t = \ \boldsymbol{\beta_1} + \ \boldsymbol{ZY_{t-1}} + \boldsymbol{\alpha_i} + \boldsymbol{\varepsilon_t}$ (*intercept only*)

$\Delta Y_t = \ \boldsymbol{\beta_1} + \boldsymbol{\beta_{2t}} + \ \boldsymbol{ZY_{t-1}} + \boldsymbol{\alpha_i} + \boldsymbol{\varepsilon_t}$ *(trend and intercept)*

$\Delta Y_t = \ \boldsymbol{ZY_{t-1}} + \boldsymbol{\alpha_i} + \boldsymbol{\varepsilon_t}$ (*no trends no intercept*)

To conform stationary or no unit root of log return using ADF test, the series must satisfy the above three formula with respect to their test critical values. If the absolute test statistics of the above three formula of ADF test is more than the absolute test critical values, only then we conclude the log return series is stationary or data has no unit-root. But If the absolute test statistics of the above three formula is less than the absolute test critical values we can say that the return series is not stationary or data has no unit root. The test has conducted only at level.

5.3 Runs test

Finally we conduct runs test to observe the randomness of stock return. Here we examine the historical return to check whether the succeeding price is independent or not. The null hypothesis, "stock return is random" tested against the alternative, "it's not random". Positive return (return > 0) is denotes by 'n_1' where's negative return (return < 0) is denotes by 'n_0' with respect to mean return. The total number of runs are 'n' which is the sum of $n_0\ and\ n_1$. The runs test implies that if the stock return is random, the actual number of runs 'r' must be equal or approximately equal to the expected number of runs 'n'. The *Z* value of runs test than compared with the test critical values of $\pm$ 1.96 at 5% significance level if the test statistics of *Z* value falls inside ±1.96 and the ρ value is $\leq$ .05. we cannot reject the null hypothesis that the price series is random.

$Z = \frac{r-\mu\ (r)}{\sigma_r}$

Where, μ (r) = 2 x$\boldsymbol{n_0}\ \boldsymbol{x}\ \boldsymbol{n_{1/n}}$

$$\sigma_r = \sqrt{\frac{2\,X\,n_0 X\,n_1 X(2Xn_0 X\,n_1 - n)}{n^2(n-1)}}$$

μ (r) = expected number of runs

σ_r = standard deviation of runs.

6. Findings and discussions

The one thousand day's daily stock return of the thirteen listed Pharmaceuticals Companies ranging from 1st January 2009 to 31st December, 2013 are almost consistent except in the early days of the period where Orion infusions, ACI and Libra infusions experienced a low market volatility. After mid-2012, Libra infusions and Pharma Aid faced huge market volatility for a short period of time. At that time Pharma Aid react with the market volatility in both directions.
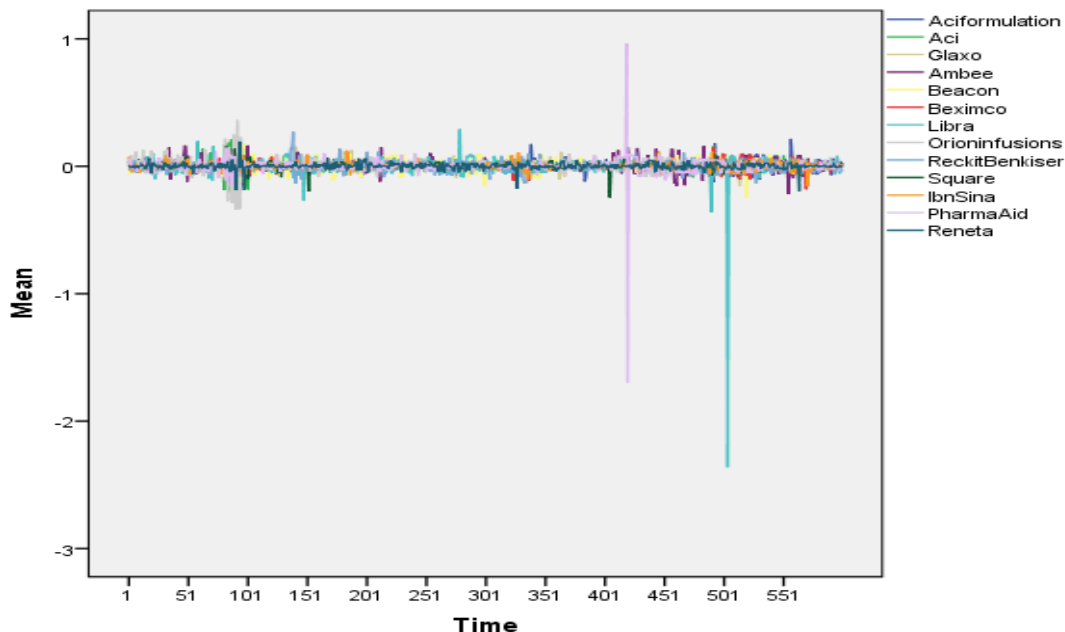

Figure 1. Trends of market return of thirteen listed Pharmaceuticals Companies in DSE

The descriptive statistics of the stock return of the thirteen listed pharmaceuticals companies are displayed in the Table.1. The daily returns are negatively skewed for ten companies which indicate that large positive returns are fewer than large negative returns of those securities. Only three companies, Glaxo, Ambee and Reckitt Benkiser shows positive skewness implies that higher positive return is more than their higher negative returns. The positive kurtosis value for all the stocks indicates the return series are leptokurtic and more peaked than standard normal distribution. The five companies, Libra infusions, Orion infusions, Square, Ibn-Sina and Pharma-Aids have extreme positive values of kurtosis indicating there high peaked ness in return distribution. The p value of the Jarque-Bera test statistics is significant at 1% level for all the securities rejecting the hypothesis of normal distribution. The z value of both skewness and kurtosis of the 12 securities falls outside the range of ±1.96 signifying the return series are not normally distributed. Only Beacon Pharmaceuticals z value of skewness falls inside the range of ±1.96 but its z value of kurtosis falls outside the range specifying this stock return is also not normally distributed.

Table 1. Descriptive Statistics of listed Pharmaceuticals Company in DSE

Company	N	Mean	Std. Deviation	Skewness		Kurtosis		Z Value of Skewness	Z Value of Kurtosis	Jarque-Bera	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error	Statistic	Statistic	Statistic	Probability
ACI Formulations Limited	998	-0.001	0.035	-1.277	0.077	30.424	0.155	-16.497	196.678	38360.98	0.000
ACI	997	-0.001	0.031	-0.213	0.077	16.490	0.155	-2.747	106.550	11182.82	0.000
Glaxo SmithKline	961	0.000	0.032	0.311	0.079	2.183	0.158	3.941	13.848	203.15	0.000
AmbeePharma	986	0.001	0.042	0.312	0.078	2.650	0.156	4.000	17.026	300.08	0.000
Beacon Pharmaceuticals Ltd	600	-0.003	0.039	-0.020	0.100	3.840	0.199	-0.196	19.282	360.76	0.000
BeximcoPharma	997	-0.001	0.028	-0.433	0.077	7.222	0.155	-5.592	46.667	2172.79	0.000
Libra Infusions Limited	706	-0.002	0.099	-19.192	0.092	456.279	0.184	-208.623	2483.452	6080945.00	0.000
Orion Infusion Ltd	922	-0.001	0.091	-19.380	0.081	506.232	0.161	-240.626	3146.165	9796028.00	0.000
Reckitt Benckiser(Bd.)Ltd	891	0.000	0.035	0.454	0.082	5.400	0.164	5.541	32.996	1098.385	0.000
Square Pharmaceuticals Ltd	996	-0.003	0.078	-26.482	0.077	782.072	0.155	-341.715	5050.750	25244736.00	0.000
The IbnSina	992	-0.003	0.079	-26.417	0.078	783.760	0.155	-340.182	5051.527	25249901.00	0.000
Pharma Aids	950	-0.003	0.105	-14.980	0.079	328.346	0.159	-188.791	2071.216	4258041.00	0.000
Renata Ltd	987	-0.002	0.076	-26.995	0.078	803.857	0.156	-346.751	5168.051	26425327.00	0.000

However, for searching the randomness of stock return, Autocorrelation and Box-Ljung statistics are being examined for further confirmation. The results of the autocorrelation clearly suggest that except ACI, the stock return of other twelve companies is completely following random walk indicating their weak form efficiency. However, in case of ACI, only autocorrelation at first lag shows a significant negative relationship but in all other lags it's completely following random walk. If the P-value of Box-Ljung statistics is (<.05), we reject the hypothesis of overall randomness of stock return. In Table.2,ACI and Pharma Aid have p-value (< .05) in all lags and Reckit Benkiser have p-value (< .05) in seven lags indicating there overall non-randomness in historical return. The other ten companies' p-value of Box-Ljung statistics is (> .05) complies with the random walk theory.

Table 2. Autocorrelation and Box-Ljung Statistics of returns

Company name	Variables	Lag-1	Lag-2	Lag-3	Lag-4	Lag-5	Lag-6	Lag-7	Lag-8	Lag-9	Lag-10
ACI Formulation	AC	-.041	-.013	.006	.018	-.003	.017	-.031	.048	.024	-.041
	Box-Ljung	1.661	1.821	1.860	2.197	2.206	2.497	3.481	5.848	6.438	8.172
	P-value	.198	.402	.602	.700	.820	.869	.837	.664	.695	.612
ACI	AC	-.276	.095	-.113	-.008	-.014	-.024	.095	.001	.003	-.050
	Box-Ljung	76.293	85.422	98.188	98.253	98.459	99.032	108.073	108.073	108.085	110.576
	P-value	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Glaxo	AC	-.030	-.050	.018	-.036	-.011	.038	.053	-.006	-.037	.012
	Box-Ljung	.884	3.276	3.602	4.873	4.994	6.400	9.173	9.210	10.556	10.708
	P-value	.347	.194	.308	.301	.417	.380	.240	.325	.307	.381
Ambee	AC	.044	.020	-.059	.023	-.053	-.009	-.002	.033	.026	-.076
	Box-Ljung	1.946	2.333	5.765	6.271	9.016	9.097	9.102	10.168	10.853	16.592
	P-value	.163	.311	.124	.180	.108	.168	.245	.253	.286	.084
Pharma Aid	AC	-.143	.008	-.019	.004	-.010	.003	-.004	-.027	.003	-.009
	Box-Ljung	19.424	19.488	19.815	19.834	19.926	19.934	19.947	20.663	20.674	20.750
	P-value	.000	.000	.000	.001	.001	.003	.006	.008	.014	.023
Reneta	AC	.000	.022	-.001	-.001	-.003	.012	-.011	.009	-.014	-.012
	Box-Ljung	.000	.459	.461	.462	.472	.611	.742	.819	1.012	1.144
	P-value	.999	.795	.927	.977	.993	.996	.998	.999	.999	1.000
Beacon	AC	.052	-.035	.032	-.097	.016	-.009	.002	.087	.015	.005
	Box-Ljung	1.606	2.337	2.959	8.669	8.823	8.869	8.871	13.523	13.652	13.668
	P-value	.205	.311	.398	.070	.116	.181	.262	.095	.135	.189
Beximco	AC	-.058	-.021	.064	.000	-.002	.066	-.041	-.001	.023	.005
	Box-Ljung	3.417	3.871	7.965	7.965	7.969	12.408	14.126	14.127	14.654	14.684
	P-value	.065	.144	.047	.093	.158	.053	.049	.079	.101	.144
Libra Infusion	AC	.035	-.011	-.020	-.001	-.051	-.039	-.005	-.024	.002	.027
	Box-Ljung	.864	.953	1.246	1.247	3.123	4.231	4.249	4.674	4.676	5.194
	P-value	.353	.621	.742	.870	.681	.645	.751	.792	.862	.878
Orion Infusion	AC	-.029	-.026	.069	.028	.009	-.054	.002	-.057	-.049	.006
	Box-Ljung	.787	1.419	5.791	6.507	6.581	9.313	9.316	12.363	14.639	14.671
	P-value	.375	.492	.122	.164	.254	.157	.231	.136	.101	.145
ReckitBenkiser	AC	.072	.000	-.064	-.053	-.040	.061	.007	-.004	.012	-.003
	Box-Ljung	4.584	4.584	8.303	10.866	12.333	15.684	15.725	15.740	15.876	15.885
	P-value	.032	.101	.040	.028	.031	.016	.028	.046	.070	.103
Square	AC	.002	.001	-.012	.018	-.004	.000	-.001	-.002	-.003	-.017
	Box-Ljung	.006	.006	.151	.468	.481	.481	.481	.486	.494	.786
	P-value	.940	.997	.985	.977	.993	.998	1.000	1.000	1.000	1.000
Ibn- Sina	AC	.009	-.010	.005	.023	.002	-.002	-.018	-.001	-.032	-.012
	Box-Ljung	.088	.196	.220	.735	.740	.745	1.084	1.084	2.099	2.232
	P-value	.767	.907	.974	.947	.981	.993	.993	.998	.990	.994

Augmented Dickey-Fuller (ADF) test is applied to check the stationary or no unit root of the stock return (log return). In Table.3 we see that the test statistics for all three equations are showing more than the test critical values @ 5% indicating the stock return are stationary or data has no unit root. The result suggests the weak form efficiency of all thirteen stock returns.

Table 3. Unit Root Test

Company	Augmented Dickey-fuller test Intercept only	Augmented Dickey-fuller test Trends and intercept	Augmented Dickey-fuller test No trends No intercept
ACI Formulation	-32.86284	-32.8471	-32.85551
ACI	-41.86494	-41.85213	-41.7745
Glaxo Smith	-31.9029	-31.97999	-31.91417
Ambee Pharma	-29.9892	-30.03668	-30.00063
Beacon	-23.26036	-23.24412	-23.15734
Beximco	-33.46615	-33.45261	-33.4362
Libra	-25.60305	-25.65201	-25.60641
Orion	-31.21668	-31.24725	-31.22765
Reckitt Benckiser	-27.75288	-27.81277	-27.76516
Square	-31.43687	-31.44782	-31.40933
Ibn Sina	-31.16777	-31.18362	-31.14589
Pharma Aid	-35.53168	-35.54369	-35.51242
Renata Ltd	-31.36739	-31.387	-31.35256

The absolute test critical values @ 5% for the above three ADF equation is 2.874258, 3.428981 and 1.942176 respectively.

The results of the runs test exhibit in Table. 4 shows that except Square and Pharma-Aid, the z value of the other eleven companies is not significant at 5% level indicating the stock return is non-random. However, though the z value of Square and Pharma-Aid are significant at 5% level but their z value falls outside the critical region () is also rejecting the hypothesis of random return. So runs test implies a predictable pattern in stock return of all thirteen companies.

Table 4. Runs Test

Variables	Aci formul	Aci	Glaxo	Ambee	Beacon	Beximco	Libra	Orion infusions	Reckit Benkiser	Square	Ibn Sina	Pharma Aid	Reneta
Mean	-0.0009	-0.0014	0.0005	0.0005	-0.0031	-0.0001	-0.0024	-0.0012	0.0005	-0.0029	-0.0027	-0.0032	-0.0024
Cases < Mean	532	525	535	544	313	528	328	481	458	416	461	457	410
Cases >= Mean	466	472	426	442	287	469	378	441	433	580	531	493	577
Total Cases	998	997	961	986	600	997	706	922	891	996	992	950	987
Number of Runs	507	487	485	498	296	485	352	435	462	437	492	440	466
Z	0.584	-0.705	0.633	0.598	-0.363	-0.811	-0.017	-1.725	1.063	-3.161	-0.162	-2.296	-0.942

Significant at 5% level

Table 5. Summery of the findings

Company Name	Augmented Dickey-fuller test for all three formula *Intercept only, Trends and intercept and No trends No intercept*	Autocorrelation and Box L-Jung statistics	Runs test
ACI Formulation	Weak form efficient	Weak form efficient	Does not support random walk
ACI	Weak form efficient	Does not support random walk	Does not support random walk
Glaxo Smith	Weak form efficient	Weak form efficient	Does not support random walk
Ambee Pharma	Weak form efficient	Weak form efficient	Does not support random walk
Beacon	Weak form efficient	Weak form efficient	Does not support random walk
Beximco	Weak form efficient	Weak form efficient	Does not support random walk
Libra	Weak form efficient	Weak form efficient	Does not support random walk
Orion	Weak form efficient	Weak form efficient	Does not support random walk
Reckitt Benckiser	Weak form efficient	Does not support random walk	Does not support random walk
Square	Weak form efficient	Weak form efficient	Does not support random walk
Ibn Sina	Weak form efficient	Weak form efficient	Does not support random walk
Pharma Aid	Weak form efficient	Does not support random walk	Does not support random walk
Renata Ltd	Weak form efficient	Weak form efficient	Does not support random walk

All test at 5% level of significance

7. Summery and conclusions

The summery of the findings are contradictory among the tests of the study. The study covers from 1st January, 2009 to 31st December, 2013. In that time DSE faces a huge market crash due to informational inefficiency in 2011. But from 2012 and onwards it's functioning smoothly and the volatility level is in tolerable range. Since our study covers both extreme volatile and smooth phases of DSE, the result is a display of average market efficiency of the pharmaceuticals industry. We have selected thirteen companies from the sixteen listed companies in DSE so the result is significant for the potential investors and all other concern bodies in this arena.

The runs tests are completely rejecting the random walk theory which is similar to the earlier study of the weak form market efficiency of DSE, Mollik & Bepari (2009), Mobarek & Keasey (2000). The results indicate the existence of predictable pattern which implies that establishing a technical trading rule can help investors to make abnormal profit.

However, the results of the ADF test strongly support the weak form market efficiency of the stocks return. It signifies that all historical information is already adjusted with the current market price. This result is more significant than the runs test because the ADF test is applied only when the error terms are correlated otherwise only Dickey-Fuller (DF) test is sufficient to examine the weak form efficiency. We have used extensive number of lag difference (up to 10 lag) to confirm that error terms are serially uncorrelated.

The autocorrelation and Box-Ljung tests are also confirming weak form efficiency for ten companies and reject for ACI, Reckitt Benkiser and Pharma Aid. This study is a snapshot of the individual security analysis in DSE. The study also suggests including more parametric test like variance ratio-test for further study.

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