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Validity of Weak Form Efficiency in European Stock Market

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Abstract

In this paper weak form efficiency is tested in ten European country indices. For this purpose Run test and Autocorrelation test are used. Run test clearly supported the dependent behavior of majority of countries. Run test has inherent weakness as only sign are conceded not how much amount of increase or decrease. The coefficients are obtained for 1-16 time lags to examine results for varying periodicity. Serial correlation coefficient statistics indicates the majority of indices are not in weak form efficiency. This study also shows that significant auto correlations are converted into insignificant with increases time lags.

Keywords: Run test; Serial correlation coefficient; Weak form efficiency

Introduction

In an efficient market, a set of information in fully and immediately reflected in market prices so that no investor is able to make excess profits based on any existing information. An efficient market is one where market price is an unbiased estimate of the true value of investment. All it require is that errors in the market price be unbiased, i.e., prices can be greater than or less than true value, as long as these deviation are random. The fact that the deviation from true value are random implies that there is an equal chance that stocks are under or over valued at any point of time, and that these deviations are uncorrelated with any observable variable. If the deviations of market prices from true values are random, it follows that no group of investors should be able to consistently earn excess return using any investment strategy. Inefficient market on the other hand offers opportunities for abnormal return to the investors. In such markets, stock which had outperformed the market in the past should continue to outperform the market in the future. Similarly, stock that has done poorly should continue to perform poorly. Rao K noted that markets could be efficient at three levels based on what information was reflected in prices [1]. A market would be described as being weak-form efficient if it is impossible to make abnormal profits by using past prices to formulate buying and selling decision. Similarly, a market would be described as being semi strong-form efficient if it is impossible to make abnormal profits by using publicly available information to formulate buying and selling decisions. Last, a market would be described as being strong-form efficient if it is impossible to make abnormal profits by using any information whatsoever to make buying and selling decisions.

A large majority of studies favor prevalence of weak form stock market efficiency. They observe that prices in the Indian stock market do not follow random walk model. They support the market efficiency preposition in its weak form both in India and abroad. Bodla has tested the weak form of efficiency with two tests, namely the runs test and serial correlation test using daily data for three year period commencing January 2001 through December 2003 [2]. The sample size consisted of 47 scrip's of S&P CNX of nifty. In order to test the null hypothesis that share prices follow the random walk behavior, the random walk model has been applied in the study. This is a suitable data transformation procedure, which is used to make the original series stationary. The results of the runs test have given a clear cut inking of the existence of weak form market efficiency in the Indian securities market. Similarly, the serial correlation analysis based on its coefficients confirms the weak form hypothesis of efficient market. This finding, thus, reduces the probability of continuously making extra profit by forecasting the security prices. Mahapatra and Biswasroy are an attempt in this direction [3]. The study is based on weekend share price data of BSE 30 scrip's covering a time period of two years i.e. from 1st April 2000 to 31st march 2002. Rank correlation analysis has been extensively used in the study to examine the rank of performance of the above 30 stocks at different time intervals. They reveals that the Indian stock market is more efficient in the weak form in the longer run but inefficient in the short run. Mishra AK has made an attempt to study documents extensive on price behavior in the Indian stock markets [4]. One of the striking features of the results is that runs analysis too exuberate weak form efficiency further and the instances of return drift noted earlier have disappeared. On the whole, the results signify that trading strategies based on historic prices cannot be relied for abnormal gains consistently, except when these coincide with underlying drifts in the stock price movements. Satish and Sonal have analyzed the weak form of efficiency and the efficient market hypothesis on Indian stock market in the form of random walk, during the period of 2007-08 based on closing prices and daily returns on the Indian stock market three representative indices: S&P CNX 500, CNX 100 and BSE 200 [5]. Serial correlation and run test support the Random Walk theory and market efficiency hypothesis. Some studies deny its existence to keep the academic debate alive on the subject. Vandana OP have studied the weak-form efficiency in Indian stock market during a period July 1988 to Jan 1996 [6-11]. The results of autocorrelation analysis as well as run analysis carried out in respect of each of the fifty shares included in the sample were not supportive of the random walk hypotheses. Some of the observed efficient were larger than those obtained in other studies. Thus the results reported here do not lend support to the view that the Indian stock market is weak form efficiency in pricing share where market efficiency is understood as generating security prices which fully reflect information contained in their historical records. This study has aimed at re-examining the weak form efficiency proposition. In the previous studies Run and auto correlation test have been used

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but more emphasis is laid on Run test. But in present study more preference is given to Autocorrelation test because this test considered sign as well as absolute change.

Hypotheses

In order to examine market efficiency in weak form, historical sequences of stock prices are studied for independence and randomness to test the following null hypothesis:

$H_{o:}$ Successive stock price movement are independent of past stock prices.

$H_{A:}$ Stock price movement are identical to that of random numbers.

Data

In order to examine the validity of null hypothesis, daily price data for a sample of ten European country indices are compiled for eight years. Data used in this study are obtained from yahoo. Finance website.

Methodology

To test independence and randomness of stock prices, Run test has been used. The number of runs is computed as a sequence of the price changes of the same sign. For testing the significance of the difference between observed and expected number of runs, standardized normal variate has been used. Since the alternative hypothesis says nothing about the direction of the deviation from a random series, a two -tailed test is applied. Accordingly, null hypothesis will be rejected at five per cent level of significance if the observed value of Z is >1.96. Expected numbers of runs of all types are computed by using the method:

$$M = \frac{2(n_1n_2 + n_1n_3 + n_2n_3)}{n_1n_2n_3} + 1$$

Where:

M = Expected number of runs;

$n_{1=}$ Number of Positive signs; and

$n_{2=}$ Number of Negative signs; and

$n_{3=}$ Number of Zeros

Wherein, standard error (S.E.) is given as:

$$\sigma = \left\{ \frac{[2(n_1n_2 + n_1n_3 + n_2n_3)]}{(n_1 + n_2 + n_3)^2 - (n_1 + n_2 + n_3 - 1)} - \frac{2(n_1n_2 + n_1n_3 + n_2n_3 + 6n_1n_2n_3)}{(n_1 + n_2 + n_3) - (n_1 + n_2 + n_3 - 1)} \right\}^{\frac{1}{2}}$$

The difference between the actual and expected number of runs is expressed by a standard normal Z variate as:

Z = [(R - M) / S.E.]

Adjusted Z variate is as follows:

Z = [(R+0.5 - M) / S.E.]

Where:

R = Actual number of runs;

M = Expected number of runs; and

SE = Standard Error

In run test, there is one limitation that is only sign is considered but not the absolute change. In order to overcome this limitation autocorrelation test is used in which raw values and direction are considered. Hence the inferences are also drawn through autocorrelation. Serial correlation is a measure of relationship between a random variable in time (P_t) and its value (P_{t-n}) periods earlier. It indicates whether price changes at time (t) are influenced by the price changes occurring (t-n) periods earlier. In order to hold weak form stock market efficiency, observed serial correlation should be statistically insignificant. Serial correlation coefficients are computed for a 1-16 periods lag(s). If the autocorrelations are close to zero or insignificant at a given significant level, the price changes are said to be serially independent. A significant positive correlation indicates the presence of a trend while the negative correlated depicts the existence of random reversals in the stock prices. The serial correlation coefficient is estimated by:

$$r_k = \frac{C_k}{C_o}$$

Where:

$$C_k = \frac{1}{n}\sum_{t=1}^{n-k}(P_t - \bar{P})(P_{t+k} - \bar{P})$$

K = 0,1,2,….n

$\bar{P} = \frac{1}{n}\sum_{t=1}^{m} P_t$ is mean of the whole series;

C_o is variance of P_t; and

n is number of observations.

Statistical testing of the serial correlation coefficient requires the standard error of estimated coefficient, which is explained below:

$$Z = r_k\sqrt{n-k}$$

Results

Statistics from medium related to run test are presented in Table 1. It shows that AEX general Index correlation coefficients are insignificant up to six years. Thereafter, correlation coefficients are showing significance significant. It can also be cited that four European countries such as Athex Composite Share Price Index, ATX, Stockholm General and OSE All Share Z value are found to be insignificant with few exception. It indicates the weak form efficiency does not present in these market. Rests of the European country indices correlation coefficient are significant at one and five per cent for different years. These country indices not strongly support randomness in the stock prices. It reveal that weak form efficiency not exist in majority European countries according to run test.

Run test Statistics from mean are reported in Table 2. It can be seen that similar trend prevailed in this Statistics. Statistics from mode gives different result as compared to mean and medium Statistics which is presented in Table 3.

Results of correlation coefficient of price changes are also used to examine the validity of null hypothesis to test the independence of successive stock prices. The coefficients are obtained for 1-16 time lags to examine results for varying periodicity. A significant interdependence in stock returns invalidates weak form market efficiency. Autocorrelation obtained for stock returns for ten countries are tabulated in Tables 4-11 for varied time lags.

It can be seen from in Tables 4-11 that majority of country indices correlation coefficient found to be significant at five percent and one percent level for up to 16 days lags. Thereafter, there are few observation

YEARS	NAME OF COUNTRY INDICES	AEX General	Athex Composite Share Price Index	ATX	BEL-20	CAC 40	DAX	FTSE 100	Stockholm General	OSE All Share	Swiss Market
First	Test Value	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.001	0.002	0.000
	Number of Runs	125	100	90	13	129	109	113	105	102	115
	Z	-0.501	-2.893	-4.399	-1.567	0.000	-2.447	-1.648	-3.175	-2.517	-1.515
	Sig. (2-tailed)	0.616	0.004	0.000	0.117	1.000	0.014	0.099	0.001	0.012	0.130
Second	Test Value	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.002	0.003	0.001
	Number of Runs	117	96	92	121	123	121	110	109	106	124
	Z	-1.740	-3.913	-4.418	-1.243	-0.994	-1.243	-2.380	-2.734	-1.002	-0.749
	Sig. (2-tailed)	0.082	0.000	0.000	0.214	0.320	0.214	0.017	0.006	0.316	0.454
Third	Test Value	0.001	0.002	0.002	0.002	0.001	0.002	0.001	0.001	0.001	0.001
	Number of Runs	122	96	105	112	122	122	103	104	100	124
	Z	-0.815	-3.634	-2.486	-2.361	-0.815	-0.815	-3.087	-3.355	-3.124	-0.316
	Sig. (2-tailed)	0.415	0.000	0.013	0.018	0.415	0.415	0.002	0.001	0.002	0.752
Fourth	Test Value	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001	0.000
	Number of Runs	117	102	105	131	123	121	109	107	97	115
	Z	-1.323	-2.927	-2.368	0.377	-0.567	-0.634	-2.213	-2.641	-3.393	-1.211
	Sig. (2-tailed)	0.186	0.003	0.018	0.706	0.571	0.526	0.027	0.008	0.001	0.226
Fifth	Test Value	-0.003	-0.003	-0.001	-0.003	-0.003	-0.003	-0.001	-0.001	-0.001	-0.002
	Number of Runs	119	102	97	109	113	109	113	105	97	105
	Z	-1.372	-3.042	-3.731	-2.620	-2.121	-2.562	-2.004	-2.777	-3.953	-3.006
	Sig. (2-tailed)	0.170	0.002	0.000	0.009	0.034	0.010	0.045	0.005	0.000	0.003
Sixth	Test Value	0.002	0.001	0.003	0.003	0.002	0.002	0.002	0.003	0.003	0.002
	Number of Runs	115	96	94	43	113	108	107	101	94	129
	Z	-1.871	-3.802	-4.056	-2.147	-2.121	-2.745	-2.698	-3.339	-4.220	-0.249
	Sig. (2-tailed)	0.061	0.000	0.000	0.032	0.034	0.006	0.007	0.001	0.000	0.804
Seventh	Test Value	0.001	-0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000
	Number of Runs	109	101	103	98	116	120	119	113	101	111
	Z	-2.734	-3.451	-3.030	-2.858	-1.864	-1.367	-1.192	-2.004	-3.282	-2.485
	Sig. (2-tailed)	0.006	0.001	0.002	0.004	0.062	0.172	0.233	0.045	0.001	0.013
Eighth	Test Value	0.000	-0.005	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.001
	Number of Runs	114	114	95	114	118	124	115	113	96	112
	Z	-2.113	-1.819	-4.040	-2.113	-1.616	-0.870	-1.694	-2.004	-4.133	-2.246
	Sig. (2-tailed)	0.035	0.069	0.000	0.035	0.106	0.384	0.090	0.045	0.000	0.025

Table 1: Run test stastics from medium.

YEARS	NAME OF COUNTRY INDICES	AEX General	Athex Composite Share Price Index	ATX	BEL-20	CAC 40	DAX	FTSE 100	Stockholm General	OSE All Share	Swiss Market
First	Test Value	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000
	Number of Runs	121	104	89	11	131	109	111	103	99	119
	Z	-0.979	-2.367	-4.429	-2.149	0.259	-2.445	-1.887	-3.419	-2.719	-0.950
	Sig. (2-tailed)	0.328	0.018	0.000	0.032	0.795	0.014	0.059	0.001	0.007	0.342
Second	Test Value	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.001
	Number of Runs	117	96	96	103	121	113	108	107	100	122
	Z	-1.594	-3.886	-3.895	-3.331	-1.154	-2.154	-2.564	-2.850	-1.581	-0.994
	Sig. (2-tailed)	0.111	0.000	0.000	0.001	0.248	0.031	0.010	0.004	0.114	0.320
Third	Test Value	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.001	0.000
	Number of Runs	120	94	100	115	120	117	101	104	100	116
	Z	-0.922	-3.617	-2.835	-1.712	-0.871	-1.130	-3.305	-3.307	-3.049	-1.244
	Sig. (2-tailed)	0.357	0.000	0.005	0.087	0.384	0.258	0.001	0.001	0.002	0.213
Fourth	Test Value	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000	-0.001	0.000	-0.001
	Number of Runs	117	102	97	133	117	119	109	103	95	113
	Z	-1.271	-2.806	-3.106	0.654	-1.295	-0.879	-2.213	-3.124	-3.453	-1.414
	Sig. (2-tailed)	0.204	0.005	0.002	0.513	0.195	0.380	0.027	0.002	0.001	0.157
Fifth	Test Value	-0.003	-0.004	-0.003	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	Number of Runs	119	102	99	109	111	107	115	109	93	107
	Z	-1.372	-3.035	-3.434	-2.620	-2.357	-2.803	-1.732	-2.269	-4.404	-2.752
	Sig. (2-tailed)	0.170	0.002	0.001	0.009	0.018	0.005	0.083	0.023	0.000	0.006
Sixth	Test Value	0.002	0.001	0.002	0.004	0.001	0.002	0.001	0.002	0.002	0.001
	Number of Runs	115	96	98	43	113	103	107	103	92	127
	Z	-1.871	-3.799	-3.536	-2.147	-2.091	-3.306	-2.673	-3.062	-4.442	-0.474
	Sig. (2-tailed)	0.061	0.000	0.000	0.032	0.037	0.001	0.008	0.002	0.000	0.636
Seventh	Test Value	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
	Number of Runs	111	105	99	100	114	119	115	109	99	109
	Z	-2.446	-2.944	-3.496	-2.595	-1.838	-1.460	-1.657	-2.404	-3.507	-2.599
	Sig. (2-tailed)	0.014	0.003	0.000	0.009	0.066	0.144	0.098	0.016	0.000	0.009
Eighth	Test Value	0.000	-0.003	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000
	Number of Runs	114	113	101	112	118	114	115	109	93	109
	Z	-2.092	-1.882	-3.125	-2.358	-1.546	-1.948	-1.630	-2.464	-4.349	-2.521
	Sig. (2-tailed)	0.036	0.060	0.002	0.018	0.122	0.051	0.103	0.014	0.000	0.012

Table 2: Run test statistics from mean.

YEARS	NAME OF COUNTRY INDICES	AEX General	Athex Composite Share Price Index	ATX	BEL-20	CAC 40	DAX	FTSE 100	Stockholm General	OSE All Share	Swiss Market
First	Test Value	0.019	0.026	0.021	0.011	0.019	0.022	0.014	0.000	0.690	0.016
	Number of Runs	3	3	3	3	3	3	3	105	3	3
	Z	0.089	0.091	0.090	0.000	0.089	0.089	0.090	-2.962	0.091	0.089
	Sig. (2-tailed)	0.929	0.927	0.928	1.000	0.929	0.929	0.928	0.003	0.927	0.929
Second	Test Value	0.018	0.021	0.024	0.014	0.023	0.024	0.014	0.028	0.035	0.016
	Number of Runs	3	3	3	3	3	3	3	3	3	3
	Z	0.088	0.089	0.089	0.088	0.088	0.088	0.089	0.088	0.095	0.088
	Sig. (2-tailed)	0.930	0.929	0.929	0.930	0.930	0.930	0.929	0.930	0.925	0.930
Third	Test Value	0.021	0.062	0.048	0.000	0.023	0.022	0.020	0.000	0.053	0.017
	Number of Runs	3	3	3	119	3	3	3	104	3	3
	Z	0.089	0.090	0.090	-0.880	0.089	0.089	0.089	-3.013	0.090	0.090
	Sig. (2-tailed)	0.929	0.928	0.928	0.379	0.929	0.929	0.929	0.003	0.928	0.929
Fourth	Test Value	0.028	0.050	0.039	0.030	0.038	0.028	0.029	0.025	0.000	0.032
	Number of Runs	3	3	3	3	3	3	3	3	97	3
	Z	0.089	0.090	0.091	0.089	0.089	0.090	0.090	0.089	-3.319	0.090
	Sig. (2-tailed)	0.929	0.928	0.928	0.929	0.929	0.928	0.929	0.929	0.001	0.928
Fifth	Test Value	0.064	0.095	0.118	0.078	0.078	0.080	0.071	0.075	0.077	0.000
	Number of Runs	3	3	3	3	3	3	3	3	3	111
	Z	0.088	0.090	0.090	0.088	0.088	0.089	0.089	0.089	0.089	-2.063
	Sig. (2-tailed)	0.930	0.928	0.929	0.930	0.930	0.929	0.929	0.929	0.929	0.039
Sixth	Test Value	0.056	0.051	0.037	0.096	0.055	0.052	0.036	0.049	0.035	0.042
	Number of Runs	2	3	2	3	2	2	2	2	2	2
	Z	-11.314	0.090	-11.136	0.139	-11.314	-11.314	-11.247	-11.203	-11.203	-11.358
	Sig. (2-tailed)	0.000	0.928	0.000	0.890	0.000	0.000	0.000	0.000	0.000	0.000
Seventh	Test Value	0.041	0.048	0.033	0.052	0.042	0.024	0.023	0.040	0.030	0.019
	Number of Runs	3	3	3	3	3	3	3	3	3	3
	Z	0.088	0.089	0.089	0.092	0.088	0.088	0.089	0.089	0.089	0.088
	Sig. (2-tailed)	0.930	0.929	0.929	0.927	0.930	0.930	0.929	0.929	0.929	0.930
Eighth	Test Value	0.044	0.083	0.056	0.046	0.045	0.054	0.032	0.038	0.038	0.049
	Number of Runs	3	3	3	3	3	3	3	3	3	3
	Z	0.088	0.089	0.089	0.088	0.088	0.088	0.089	0.089	0.089	0.088
	Sig. (2-tailed)	0.930	0.929	0.929	0.930	0.930	0.930	0.929	0.929	0.929	0.930

Table 3: Run test statistics from mode.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.1	-0.03	0.09	0	0	0.02	0.01	-0.03	-0.03	0.01	0.06	-0.02	-0.06	-0.01	-0.05	-0.05
	Value	2.46	2.69	4.77	4.78	4.78	4.87	4.9	5.12	5.36	5.41	6.44	6.58	7.71	7.73	8.35	9
	P Value	0.12	0.26	0.19	0.31	0.44	0.56	0.67	0.74	0.8	0.86	0.84	0.88	0.86	0.9	0.91	0.91
Athex Composite Share Price Index	Autocorrelation	0.3	-0.06	-0.02	-0.01	-0.05	0.03	0.08	0.04	0.02	0.12	0.04	-0.03	0	0.03	-0.04	0
	Value	22.19	23.14	23.25	23.3	23.98	24.18	25.65	26.04	26.19	29.85	30.27	30.57	30.57	30.85	31.3	31.31
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01
ATX	Autocorrelation	0.45	-0.05	-0.19	-0.06	0.17	0.14	-0.04	-0.11	-0.01	0.1	0.12	0	-0.09	-0.04	0	0.08
	Value	50.84	51.39	60	60.9	68.45	73.33	73.75	77.08	77.1	79.87	83.6	83.6	85.59	86.01	86.01	87.51
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BEL-20	Autocorrelation	0.33	-0.21	-0.29	-0.01	0.09	-0.1	-0.14	-0.22	-0.09	-0.17	-0.13	-0.01	0.23	0.34	0.01	-0.13
	Value	4.13	5.75	9.08	9.08	9.43	9.82	10.71	13.06	13.45	14.9	15.75	15.75	18.73	25.91	25.91	27.01
	P Value	0.04	0.06	0.03	0.06	0.09	0.13	0.15	0.11	0.14	0.14	0.15	0.2	0.13	0.03	0.04	0.04
CAC 40	Autocorrelation	0.04	-0.1	-0.02	-0.04	0.03	-0.02	0	-0.02	-0.04	0.04	0.03	-0.01	-0.06	0	-0.05	-0.03
	Value	0.4	3.22	3.35	3.7	3.98	4.13	4.13	4.2	4.72	5.19	5.41	5.42	6.52	6.52	7.18	7.35
	P Value	0.53	0.2	0.34	0.45	0.55	0.66	0.77	0.84	0.86	0.88	0.91	0.94	0.93	0.95	0.95	0.97
DAX	Autocorrelation	0.18	-0.01	0.03	-0.01	-0.03	0.01	0.03	-0.11	-0.12	-0.02	0.02	-0.03	-0.01	0.02	-0.07	0
	Value	8.56	8.58	8.82	8.83	9.02	9.06	9.33	12.36	15.89	15.94	16.06	16.26	16.29	16.38	17.87	17.87
	P Value	0	0.01	0.03	0.07	0.11	0.17	0.23	0.14	0.07	0.1	0.14	0.18	0.23	0.29	0.27	0.33
FTSE 100	Autocorrelation	0.23	0.04	0	0.04	0.02	0.04	0.01	-0.02	-0.06	0.04	0.04	0	-0.04	-0.11	-0.13	-0.03
	Value	12.83	13.16	13.16	13.47	13.55	14	14.04	14.15	15.02	15.43	15.75	15.75	16.15	19.37	23.54	23.84
	P Value	0	0	0	0.01	0.02	0.03	0.05	0.08	0.09	0.12	0.15	0.2	0.24	0.15	0.07	0.09
Stockholm General	Autocorrelation	0.27	0.01	-0.01	-0.01	0.05	0.02	0.01	-0.09	-0.07	-0.01	0.01	-0.02	-0.02	0	-0.17	-0.06
	Value	19.28	19.33	19.38	19.38	20.06	20.18	20.22	22.21	23.46	23.5	23.55	23.66	23.72	23.73	31.56	32.53
	P Value	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.01	0.01
OSE All Share	Autocorrelation	-0.49	0	0	-0.01	0.01	0	0.01	-0.02	-0.01	0.01	0.01	-0.02	0	0.01	0	0.01
	Value	60.28	60.28	60.28	60.32	60.34	60.34	60.34	60.41	60.42	60.46	60.49	60.55	60.55	60.57	60.57	60.58
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swiss Market	Autocorrelation	0.1	-0.09	-0.05	-0.01	0.1	0.03	0	-0.1	-0.04	0.12	0.05	-0.14	-0.11	-0.07	-0.08	0.01
	Value	2.61	4.86	5.43	5.43	8.23	8.4	8.4	10.88	11.22	15.17	15.81	20.79	24.28	25.64	27.25	27.25
	P Value	0.11	0.09	0.14	0.25	0.14	0.21	0.3	0.21	0.26	0.13	0.15	0.05	0.03	0.03	0.03	0.04

Table 4: Serial Auto correlation Statistic in first year.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.19	-0.01	0.05	0.02	0.04	-0.06	-0.01	0.03	0.03	0.01	0.02	-0.04	-0.08	-0.03	0.06	-0.04
	Value	9.26	9.3	10.02	10.12	10.45	11.38	11.42	11.71	12	12.02	12.1	12.55	14.33	14.62	15.49	15.97
	P Value	0	0.01	0.02	0.04	0.06	0.08	0.12	0.16	0.21	0.28	0.36	0.4	0.35	0.41	0.42	0.46
Athex Composite Share Price Index	Autocorrelation	0.3	0	0.07	-0.04	-0.01	-0.05	-0.07	-0.13	-0.08	0.04	0.01	-0.05	-0.01	0.05	0.02	-0.02
	Value	23.56	23.56	24.64	24.98	25.02	25.65	26.77	30.93	32.61	33.09	33.1	33.66	33.67	34.23	34.35	34.45
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01
ATX	Autocorrelation	0.31	-0.03	0.07	0	0.05	0.06	-0.08	-0.04	0.06	-0.07	-0.07	0.01	0.05	0.03	0.03	-0.03
	Value	24.32	24.54	25.83	25.83	26.41	27.35	29.06	29.38	30.36	31.75	32.92	32.94	33.48	33.72	33.99	34.28
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01
BEL-20	Autocorrelation	0.21	-0.06	-0.02	-0.05	0.05	-0.08	-0.03	0.02	0.12	-0.01	-0.07	-0.02	-0.06	-0.01	0.03	0.02
	Value	11.29	12.36	12.51	13.26	13.89	15.44	15.74	15.85	19.79	19.8	21.08	21.19	22.25	22.27	22.59	22.73
	P Value	0	0	0.01	0.01	0.02	0.02	0.03	0.05	0.02	0.03	0.03	0.05	0.05	0.07	0.09	0.12
CAC 40	Autocorrelation	0.1	-0.11	0	-0.03	-0.02	-0.03	-0.02	-0.03	0.04	-0.02	-0.03	-0.07	-0.05	0.01	0.09	0.01
	Value	2.8	6.11	6.12	6.42	6.49	6.74	6.83	7.08	7.54	7.61	7.89	9.07	9.8	9.85	11.94	11.98
	P Value	0.09	0.05	0.11	0.17	0.26	0.35	0.45	0.53	0.58	0.67	0.72	0.7	0.71	0.77	0.68	0.75
DAX	Autocorrelation	0.18	-0.01	-0.01	-0.06	-0.06	-0.02	0.01	-0.03	-0.01	-0.06	-0.08	-0.07	-0.06	0.01	0.12	0.03
	Value	8.75	8.76	8.81	9.86	10.84	10.98	11.01	11.19	11.19	12.03	13.58	14.94	15.91	15.94	19.9	20.15
	P Value	0	0.01	0.03	0.04	0.06	0.09	0.14	0.19	0.26	0.28	0.26	0.25	0.25	0.32	0.18	0.21
FTSE 100	Autocorrelation	0.19	-0.08	0.05	0.01	0.04	0.01	-0.09	-0.05	0.03	0.01	-0.01	-0.14	-0.16	-0.06	0.05	-0.06
	Value	9.22	11	11.69	11.7	12.07	12.09	14.09	14.83	15.01	15.07	15.09	20.33	26.95	28.01	28.81	29.72
	P Value	0	0	0.01	0.02	0.03	0.06	0.05	0.06	0.09	0.13	0.18	0.06	0.01	0.01	0.02	0.02
Stockholm General	Autocorrelation	0.21	-0.04	-0.02	-0.01	0.1	0.02	-0.02	0.02	-0.03	-0.03	-0.07	-0.03	-0.07	-0.02	0.02	-0.04
	Value	11.53	11.93	12.02	12.07	14.59	14.69	14.8	14.9	15.12	15.37	16.8	17.04	18.56	18.63	18.7	19.14
	P Value	0	0	0.01	0.02	0.01	0.02	0.04	0.06	0.09	0.12	0.11	0.15	0.14	0.18	0.23	0.26
OSE All Share	Autocorrelation	0.19	0.04	0.11	-0.04	0	-0.02	0.09	-0.02	-0.06	-0.11	-0.13	0.02	-0.01	-0.04	0.01	-0.04
	Value	7.94	8.26	11.25	11.59	11.59	11.66	13.34	13.47	14.4	17.32	21.5	21.59	21.61	21.95	21.99	22.32
	P Value	0.01	0.02	0.01	0.02	0.04	0.07	0.06	0.1	0.11	0.07	0.03	0.04	0.06	0.08	0.11	0.13
Swiss Market	Autocorrelation	0.03	-0.05	-0.02	-0.02	0.09	0.04	-0.04	-0.08	0.03	-0.05	-0.02	-0.04	-0.04	-0.02	0.02	0
	Value	0.28	1.02	1.11	1.22	3.22	3.54	3.97	5.72	5.98	6.65	6.81	7.21	7.55	7.63	7.71	7.72
	P Value	0.6	0.6	0.77	0.88	0.67	0.74	0.78	0.68	0.74	0.76	0.81	0.84	0.87	0.91	0.94	0.96

Table 5: Serial Auto correlation Statistic in second year.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.257	0.023	0.013	-0.048	-0.054	-0.036	-0.089	-0.08	0.044	0.1	0.071	-0.087	-0.055	-0.018	-0.015	-0.051
	Value	17.086	17.226	17.269	17.882	18.658	19.006	21.093	22.808	23.318	25.998	27.357	29.413	30.217	30.304	30.369	31.096
	P Value	0	0	0.001	0.001	0.002	0.004	0.004	0.004	0.006	0.004	0.004	0.003	0.004	0.007	0.011	0.013
Athex Composite Share Price Index	Autocorrelation	0.219	-0.001	0.126	-0.1	-0.051	-0.07	-0.065	0.016	0.055	0.03	-0.016	0.086	0.118	0.016	0.08	-0.037
	Value	12.038	12.039	16.017	18.566	19.216	20.454	21.54	21.609	22.395	22.631	22.698	24.631	28.302	28.372	30.052	30.417
	P Value	0.001	0.002	0.001	0.001	0.002	0.002	0.003	0.006	0.008	0.012	0.019	0.017	0.008	0.013	0.012	0.016
ATX	Autocorrelation	0.263	0.024	0.015	0.048	0.072	-0.113	-0.139	-0.068	0.038	0.059	-0.018	0.04	-0.039	0.109	0.042	-0.104
	Value	17.273	17.412	17.47	18.065	19.397	22.671	27.635	28.819	29.2	30.112	30.193	30.614	31.022	34.137	34.615	37.499
	P Value	0	0	0.001	0.001	0.002	0.001	0	0	0.001	0.001	0.001	0.002	0.003	0.002	0.003	0.002
BEL-20	Autocorrelation	0.245	0.018	0.025	0.021	-0.031	-0.017	-0.07	-0.132	0.032	0.057	0.023	-0.065	-0.03	-0.055	0.034	-0.006
	Value	15.767	15.852	16.023	16.136	16.392	16.466	17.804	22.501	22.778	23.678	23.827	24.983	25.236	26.07	26.39	26.4
	P Value	0	0	0.001	0.003	0.006	0.011	0.013	0.004	0.007	0.009	0.013	0.015	0.021	0.025	0.034	0.049
CAC 40	Autocorrelation	0.205	-0.043	-0.02	0.01	-0.025	-0.044	-0.122	-0.113	0.009	0.107	0.058	-0.13	-0.061	0.011	0.041	-0.053
	Value	10.81	11.286	11.387	11.413	11.576	12.087	16.024	19.388	19.412	22.484	23.386	27.913	28.912	28.944	29.405	30.178
	P Value	0.001	0.004	0.01	0.022	0.041	0.06	0.025	0.013	0.022	0.013	0.016	0.006	0.007	0.011	0.014	0.017
DAX	Autocorrelation	0.227	-0.021	0.013	-0.023	-0.036	-0.04	-0.076	-0.091	-0.016	0.06	0.068	-0.025	-0.015	0.006	0	-0.056
	Value	13.346	13.46	13.506	13.645	13.978	14.406	15.928	18.145	18.21	19.165	20.405	20.567	20.63	20.64	20.64	21.506
	P Value	0	0.001	0.004	0.009	0.016	0.025	0.026	0.02	0.033	0.038	0.04	0.057	0.081	0.111	0.149	0.16
FTSE 100	Autocorrelation	0.292	-0.012	0.062	-0.042	-0.097	-0.073	-0.066	-0.089	-0.006	0.064	0.004	-0.059	-0.083	-0.018	0.027	-0.029
	Value	21.777	21.811	22.789	23.24	25.691	27.065	28.223	30.294	30.304	31.401	31.406	32.325	34.18	34.265	34.462	34.695
	P Value	0	0	0	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.002	0.003	0.004
Stockholm General	Autocorrelation	0.283	-0.003	0.158	-0.043	-0.091	-0.013	-0.113	-0.164	-0.039	0.004	-0.01	0.031	0.025	-0.007	0.08	0.086
	Value	21.039	21.042	27.661	28.159	30.378	30.422	33.847	41.155	41.568	41.572	41.599	41.861	42.033	42.046	43.816	45.863
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OSE All Share	Autocorrelation	0.244	-0.075	0.166	-0.085	-0.14	-0.004	-0.143	-0.045	0.09	-0.069	-0.041	0.073	0.007	0.113	0.048	-0.157
	Value	14.922	16.347	23.317	25.133	30.108	30.111	35.338	35.856	37.96	39.211	39.641	41.04	41.054	44.437	45.044	51.641
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swiss Market	Autocorrelation	0.227	-0.014	-0.002	0	-0.066	-0.088	-0.088	-0.048	-0.005	0.09	0.101	0.024	0.045	0.022	-0.007	-0.066
	Value	13.132	13.178	13.179	13.18	14.298	16.297	18.332	18.942	18.949	21.078	23.756	23.91	24.461	24.587	24.601	25.793
	P Value	0	0.001	0.004	0.01	0.014	0.012	0.011	0.015	0.026	0.021	0.014	0.021	0.027	0.039	0.056	0.057

Table 6: Serial Auto correlation Statistic in third year.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.12	-0.08	0.04	0.07	0.01	-0.09	0.07	0.08	-0.06	-0.04	0.09	0.01	0.01	0.03	-0.06	-0.03
	Value	3.71	5.39	5.86	7.26	7.3	9.33	10.44	11.94	12.89	13.25	15.25	15.31	15.36	15.57	16.57	16.79
	P Value	0.05	0.07	0.12	0.12	0.2	0.16	0.17	0.15	0.17	0.21	0.17	0.23	0.29	0.34	0.35	0.4
Athex Composite Share Price Index	Autocorrelation	0.15	-0.01	0.08	0.11	-0.02	-0.01	0.05	0	-0.05	-0.06	-0.02	0.02	-0.01	-0.06	-0.05	-0.04
	Value	5.76	5.8	7.28	10.26	10.38	10.41	11.05	11.05	11.71	12.77	12.85	12.92	12.95	13.9	14.46	14.85
	P Value	0.02	0.06	0.06	0.04	0.07	0.11	0.14	0.2	0.23	0.24	0.3	0.38	0.45	0.46	0.49	0.54
ATX	Autocorrelation	0.17	0.03	0.03	0.02	-0.02	-0.03	-0.01	0.02	-0.06	-0.11	0.08	-0.05	0	0	-0.02	-0.01
	Value	7.53	7.8	7.98	8.04	8.18	8.4	8.45	8.56	9.46	12.58	14.1	14.65	14.65	14.65	14.72	14.75
	P Value	0.01	0.02	0.05	0.09	0.15	0.21	0.3	0.38	0.4	0.25	0.23	0.26	0.33	0.4	0.47	0.54
BEL-20	Autocorrelation	0.1	-0.04	0.01	0.07	-0.08	-0.09	-0.01	-0.01	-0.05	-0.01	0.04	-0.03	0.06	0.01	-0.05	-0.05
	Value	2.43	2.82	2.85	4.27	5.92	8	8	8.01	8.57	8.58	8.92	9.1	10.05	10.1	10.8	11.54
	P Value	0.12	0.24	0.42	0.37	0.31	0.24	0.33	0.43	0.48	0.57	0.63	0.7	0.69	0.76	0.77	0.78
CAC 40	Autocorrelation	0.08	-0.08	0	0	0	-0.07	0.03	0.02	-0.07	0.01	0.08	0.02	0.05	0.06	-0.08	-0.01
	Value	1.47	2.97	2.97	2.97	2.97	4.29	4.6	4.67	6	6.01	7.52	7.6	8.17	9.05	10.97	10.98
	P Value	0.23	0.23	0.4	0.56	0.71	0.64	0.71	0.79	0.74	0.81	0.76	0.82	0.83	0.83	0.76	0.81
DAX	Autocorrelation	0.15	0.01	0	0	-0.02	-0.06	0.03	0	-0.06	0.1	0.13	0.05	0.03	0.01	-0.12	-0.06
	Value	5.88	5.89	5.89	5.9	5.98	7.05	7.27	7.28	8.25	10.84	15.15	15.82	16	16.05	20.01	21.11
	P Value	0.02	0.05	0.12	0.21	0.31	0.32	0.4	0.51	0.51	0.37	0.18	0.2	0.25	0.31	0.17	0.17
FTSE 100	Autocorrelation	0.18	-0.11	-0.06	0	0.01	-0.06	0.02	0	-0.12	-0.02	0.1	-0.03	0.03	0	-0.02	0.03
	Value	8.49	11.74	12.57	12.57	12.58	13.45	13.53	13.53	16.97	17.11	19.77	19.96	20.21	20.21	20.33	20.59
	P Value	0	0	0.01	0.01	0.03	0.04	0.06	0.1	0.05	0.07	0.05	0.07	0.09	0.12	0.16	0.2
Stockholm General	Autocorrelation	0.2	-0.07	-0.02	-0.02	-0.04	-0.02	0.06	0.04	-0.06	-0.03	0.03	-0.03	-0.05	-0.08	-0.08	-0.03
	Value	10.72	11.9	11.99	12.06	12.41	12.5	13.51	13.91	14.86	15.08	15.34	15.58	16.23	17.82	19.59	19.81
	P Value	0	0	0.01	0.02	0.03	0.05	0.06	0.08	0.1	0.13	0.17	0.21	0.24	0.22	0.19	0.23
OSE All Share	Autocorrelation	0.23	0.02	0.04	0.11	-0.08	-0.02	0.04	0.04	0.02	-0.08	0.01	-0.03	0	-0.06	-0.01	0.01
	Value	13.04	13.16	13.54	16.79	18.58	18.68	19.07	19.43	19.51	20.95	20.98	21.26	21.27	22.07	22.1	22.15
	P Value	0	0	0	0	0	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.07	0.08	0.11	0.14
Swiss Market	Autocorrelation	0.16	-0.13	-0.07	-0.06	0.05	-0.08	-0.03	0.02	-0.06	0.01	0.13	0.01	-0.01	-0.1	-0.09	0.03
	Value	6.45	10.86	12.07	12.91	13.55	15.06	15.22	15.34	16.21	16.23	20.38	20.39	20.42	23.15	25.47	25.72
	P Value	0.01	0	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.09	0.04	0.06	0.09	0.06	0.04	0.06

Table 7: Serial Auto correlation Statistic in forth year.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.13	-0.12	-0.09	0.07	0.03	-0.07	0.07	0.14	0.04	-0.05	-0.03	0.02	-0.05	-0.04	-0.06	0.09
	Value	4.54	8.5	10.79	11.99	12.27	13.68	15.09	20.37	20.73	21.37	21.56	21.69	22.39	22.93	24.07	26.12
	P Value	0.03	0.01	0.01	0.02	0.03	0.03	0.04	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.06	0.05
Athex Composite Share Price Index	Autocorrelation	0.28	-0.08	0.06	0.09	-0.04	-0.09	-0.05	-0.02	-0.07	0	-0.02	-0.06	0.06	0.01	-0.04	0.01
	Value	19.31	20.95	21.87	24.15	24.61	26.91	27.67	27.81	29.17	29.17	29.31	30.17	31.22	31.24	31.72	31.74
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01
ATX	Autocorrelation	0.27	-0.08	-0.01	0	-0.03	0	0.02	0.01	0	-0.08	-0.08	0.03	0.08	0.01	-0.01	0.13
	Value	18.77	20.54	20.55	20.55	20.72	20.72	20.86	20.88	20.88	22.4	24.26	24.48	26.12	26.14	26.18	30.73
	P Value	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.02
BEL-20	Autocorrelation	0.18	-0.1	-0.08	0.13	0.08	-0.06	0.04	0.16	0.01	-0.13	-0.05	0.06	-0.01	-0.09	-0.18	0.03
	Value	8.19	10.79	12.31	16.66	18.54	19.4	19.78	26.59	26.6	31.21	31.85	32.75	32.8	35.25	44.13	44.45
	P Value	0	0.01	0.01	0	0	0	0.01	0	0	0	0	0	0	0	0	0
CAC 40	Autocorrelation	0.1	-0.18	-0.11	0.14	-0.01	-0.07	0.02	0.04	-0.05	-0.06	-0.02	0.05	-0.07	-0.05	-0.08	0.08
	Value	2.37	10.94	14.06	19.07	19.11	20.57	20.7	21.19	21.91	22.97	23.09	23.81	25.06	25.81	27.49	29.14
	P Value	0.12	0	0	0	0	0	0	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.02
DAX	Autocorrelation	0.13	-0.12	-0.05	0.1	-0.02	-0.07	0.03	-0.08	0	0.05	-0.03	-0.07	-0.03	-0.1	-0.1	0.05
	Value	4.24	8.23	8.77	11.36	11.42	12.82	13.06	14.96	14.96	15.76	16.08	17.23	17.42	19.95	22.58	23.2
	P Value	0.04	0.02	0.03	0.02	0.04	0.05	0.07	0.06	0.09	0.11	0.14	0.14	0.18	0.13	0.09	0.11
FTSE 100	Autocorrelation	0.21	-0.19	-0.04	0.1	-0.05	-0.11	0.07	0.05	0.03	-0.04	-0.01	-0.05	0	-0.09	-0.11	0.04
	Value	11.15	20.43	20.77	23.62	24.39	27.46	28.89	29.45	29.72	30.18	30.2	30.93	30.93	33.21	36.74	37.12
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stockholm General	Autocorrelation	0.28	-0.15	-0.02	0.04	-0.06	-0.12	0.02	0.02	-0.07	-0.12	-0.01	0.09	0.04	-0.05	-0.07	0.1
	Value	19.54	24.9	24.96	25.36	26.36	30.02	30.17	30.31	31.49	35.06	35.09	37.36	37.7	38.42	39.54	42.06
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OSE All Share	Autocorrelation	0.28	-0.08	-0.04	0	-0.04	-0.05	0.05	-0.03	0.07	-0.02	-0.09	-0.04	0.07	0.08	0.02	0.11
	Value	20.53	22.3	22.67	22.68	23.04	23.61	24.36	24.57	25.92	26	28.12	28.53	29.83	31.36	31.49	34.82
	P Value	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0
Swiss Market	Autocorrelation	0.13	-0.19	-0.07	0.13	-0.09	-0.16	-0.05	0.04	0.03	0.04	-0.01	0	-0.04	-0.02	-0.09	0.02
	Value	4.23	13.65	14.94	19.19	21.18	27.78	28.53	29.04	29.26	29.65	29.66	29.66	30.12	30.24	32.59	32.69
	P Value	0.04	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01

Table 8: Serial Auto correlation Statistic in fifth year.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.27	-0.05	-0.09	0	0.03	-0.09	-0.07	-0.02	-0.03	-0.05	-0.04	0.02	0.1	0.03	-0.03	-0.05
	Value	19.59	20.14	22.08	22.08	22.28	24.23	25.36	25.45	25.77	26.43	26.92	27	29.47	29.79	30.07	30.83
	P Value	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01
Athex Composite Share Price Index	Autocorrelation	0.3	-0.07	-0.07	-0.02	-0.04	-0.02	0.14	0.07	-0.05	-0.07	0.01	0.16	0.09	0.03	0.03	0.04
	Value	23.18	24.31	25.46	25.56	26.05	26.13	31.16	32.25	32.89	34.08	34.12	40.96	43.14	43.34	43.52	43.9
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ATX	Autocorrelation	0.33	-0.04	-0.11	-0.06	-0.05	-0.06	-0.03	-0.07	-0.07	-0.04	-0.14	-0.05	0.12	0.03	0.01	0.05
	Value	28.04	28.39	31.28	32.24	32.86	33.65	33.84	35.26	36.36	36.82	41.72	42.39	46.49	46.8	46.84	47.47
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BEL-20	Autocorrelation	0.15	-0.1	-0.06	-0.15	-0.09	0	0.09	0.12	0.06	-0.03	-0.09	0.06	0.15	0.06	-0.01	0.03
	Value	2.45	3.64	4.01	6.48	7.44	7.44	8.44	10.2	10.66	10.77	11.67	12.15	15.02	15.45	15.47	15.6
	P Value	0.12	0.16	0.26	0.17	0.19	0.28	0.3	0.25	0.3	0.38	0.39	0.43	0.31	0.35	0.42	0.48
CAC 40	Autocorrelation	0.27	-0.06	-0.09	0	0.08	-0.05	-0.05	0.02	-0.02	-0.05	-0.08	0.01	0.07	0.05	0	-0.04
	Value	19.6	20.46	22.4	22.4	23.94	24.48	25.09	25.21	25.3	26.09	27.97	27.98	29.23	29.95	29.95	30.3
	P Value	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.02
DAX	Autocorrelation	0.29	-0.04	-0.07	-0.01	0.1	-0.01	-0.08	-0.03	0.01	0.02	-0.06	-0.04	0.06	0.05	-0.03	-0.04
	Value	22.55	23.05	24.36	24.38	27.14	27.19	29.04	29.27	29.28	29.39	30.44	30.93	32.02	32.78	33.09	33.56
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01
FTSE 100	Autocorrelation	0.29	-0.05	-0.08	-0.08	0.05	0.02	0.07	0.09	0.04	-0.08	-0.17	-0.03	0.03	0.06	0.05	-0.02
	Value	21.51	22.04	23.63	25.25	26.03	26.12	27.41	29.35	29.72	31.23	38.57	38.85	39.04	39.87	40.51	40.57
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stockholm General	Autocorrelation	0.14	-0.07	-0.07	-0.07	-0.04	-0.09	0.1	0.01	0.06	-0.01	-0.1	0.05	0.06	-0.02	0.03	0.07
	Value	4.72	5.82	7.04	8.44	8.95	10.91	13.51	13.54	14.34	14.35	17.16	17.94	18.75	18.81	19.05	20.44
	P Value	0.03	0.05	0.07	0.08	0.11	0.09	0.06	0.1	0.11	0.16	0.1	0.12	0.13	0.17	0.21	0.2
OSE All Share	Autocorrelation	0.33	-0.03	-0.09	-0.07	-0.01	0	-0.03	-0.01	-0.04	-0.01	-0.02	-0.03	0.16	0.09	-0.05	0
	Value	28.57	28.87	30.85	32.26	32.27	32.27	32.51	32.56	33.01	33.04	33.12	33.36	40.01	42.02	42.74	42.75
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swiss Market	Autocorrelation	0.08	-0.11	-0.14	-0.06	0.15	-0.02	-0.12	-0.01	-0.01	0.05	-0.02	-0.02	0.11	-0.01	-0.07	-0.02
	Value	1.65	4.63	9.54	10.36	16.23	16.31	20.01	20.04	20.08	20.63	20.79	20.86	23.94	23.95	25.48	25.61
	P Value	0.2	0.1	0.02	0.04	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.05	0.03	0.05	0.04	0.06

Table 9: Serial Auto correlation Statistic in sixth year.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.119	0.055	-0.06	-0.042	-0.059	-0.027	-0.059	-0.09	-0.113	0.044	0.022	0.171	0.031	-0.084	-0.116	-0.04
	Value	3.735	4.539	5.488	5.968	6.886	7.078	8.005	10.217	13.668	14.189	14.317	22.334	22.598	24.569	28.278	28.728
	P Value	0.053	0.103	0.139	0.202	0.229	0.314	0.332	0.25	0.135	0.165	0.216	0.034	0.047	0.039	0.02	0.026
Athex Composite Share Price Index	Autocorrelation	0.295	-0.095	-0.144	-0.074	0.02	0.075	0.042	0.07	-0.003	-0.081	-0.074	-0.001	0.146	0.162	-0.009	-0.117
	Value	22.394	24.715	30.113	31.536	31.643	33.109	33.574	34.856	34.859	36.613	38.099	38.099	43.878	50.989	51.012	54.737
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ATX	Autocorrelation	0.351	-0.011	-0.068	-0.093	-0.088	-0.112	-0.011	0.012	0.052	0.106	0.066	0.005	-0.069	-0.057	-0.094	-0.083
	Value	31.453	31.487	32.676	34.894	36.922	40.21	40.242	40.283	40.989	43.983	45.135	45.142	46.405	47.28	49.654	51.516
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BEL-20	Autocorrelation	0.052	-0.002	-0.04	-0.058	-0.085	0.009	-0.14	-0.093	-0.092	0.068	-0.048	0.153	0.005	-0.09	-0.052	0.022
	Value	0.661	0.662	1.044	1.861	3.633	3.655	8.533	10.659	12.776	13.932	14.522	20.473	20.48	22.527	23.211	23.341
	P Value	0.416	0.718	0.791	0.761	0.603	0.723	0.288	0.222	0.173	0.176	0.205	0.059	0.084	0.068	0.08	0.105
CAC 40	Autocorrelation	0.151	0.02	-0.046	-0.041	-0.047	0.005	-0.031	-0.094	-0.111	0.002	0.019	0.133	0.049	-0.09	-0.063	-0.029
	Value	6.004	6.11	6.675	7.119	7.719	7.727	7.979	10.386	13.736	13.738	13.838	18.671	19.329	21.571	22.671	22.913
	P Value	0.014	0.047	0.083	0.13	0.172	0.259	0.334	0.239	0.132	0.185	0.242	0.097	0.113	0.088	0.091	0.116
DAX	Autocorrelation	0.153	-0.002	-0.031	-0.018	-0.073	-0.105	-0.037	-0.077	-0.102	0.009	0.032	0.119	0.06	-0.088	-0.022	-0.03
	Value	6.122	6.123	6.374	6.461	7.872	10.821	11.185	12.807	15.639	15.662	15.943	19.846	20.833	22.988	23.123	23.38
	P Value	0.013	0.047	0.095	0.167	0.163	0.094	0.131	0.119	0.075	0.11	0.143	0.07	0.076	0.06	0.082	0.104
FTSE 100	Autocorrelation	0.252	-0.005	0.069	0.046	-0.102	-0.086	-0.104	-0.11	-0.031	0.088	0.055	0.055	0.025	-0.039	-0.044	-0.045
	Value	16.378	16.384	17.619	18.18	20.91	22.859	25.692	28.908	29.168	31.254	32.069	32.89	33.065	33.469	33.995	34.539
	P Value	0	0	0.001	0.001	0.001	0.001	0.001	0	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.005
Stockholm General	Autocorrelation	0.195	-0.018	-0.092	-0.067	-0.049	-0.057	-0.048	-0.023	0.015	-0.014	0.1	0.037	0.024	-0.066	-0.1	0.007
	Value	9.887	9.975	12.206	13.367	14.005	14.862	15.482	15.628	15.686	15.74	18.444	18.824	18.985	20.183	22.93	22.942
	P Value	0.002	0.007	0.007	0.01	0.016	0.021	0.03	0.048	0.074	0.107	0.072	0.093	0.124	0.124	0.086	0.115
OSE All Share	Autocorrelation	0.369	0.035	-0.095	-0.108	-0.139	-0.12	0.01	0.001	0.001	0.046	-0.012	-0.04	-0.008	0.036	-0.041	-0.139
	Value	34.91	35.221	37.547	40.579	45.607	49.325	49.349	49.349	49.349	49.901	49.942	50.365	50.384	50.726	51.176	56.424
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swiss Market	Autocorrelation	0.203	-0.012	-0.044	0.007	-0.016	-0.06	-0.081	-0.143	-0.094	0.088	0.067	-0.014	-0.042	-0.067	-0.041	-0.057
	Value	10.86	10.896	11.411	11.423	11.491	12.446	14.194	19.711	22.118	24.225	25.456	25.51	25.999	27.227	27.695	28.599
	P Value	0.001	0.004	0.01	0.022	0.042	0.053	0.048	0.011	0.009	0.007	0.008	0.013	0.017	0.018	0.024	0.027

Table 10: Serial Auto correlation Statistic in seventh year.

Name of country Indices	Lag	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
AEX General	Autocorrelation	0.22	0	-0.09	-0.11	0	0.02	0	-0.02	-0.12	-0.01	0.06	-0.02	0.08	0.02	-0.02	0.07
	Value	12.69	12.69	14.68	17.71	17.71	17.83	17.83	17.9	21.55	21.57	22.55	22.62	24.34	24.45	24.55	25.87
	P Value	0	0	0	0	0	0.01	0.01	0.02	0.01	0.02	0.02	0.03	0.03	0.04	0.06	0.06
Athex Composite Share Price Index	Autocorrelation	0.21	-0.15	-0.03	0.08	0.01	-0.03	-0.02	0.08	0.05	-0.02	-0.03	0.05	-0.03	-0.13	0.03	0.12
	Value	11.04	16.51	16.82	18.28	18.32	18.62	18.77	20.65	21.22	21.33	21.57	22.13	22.38	27.07	27.27	31.31
	P Value	0	0	0	0	0	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.02	0.03	0.01
ATX	Autocorrelation	0.26	0.02	-0.15	-0.05	-0.02	0	0.07	-0.03	-0.1	0	-0.04	0.04	0.05	0.04	0.06	0.05
	Value	17.83	17.93	23.59	24.22	24.34	24.34	25.68	25.94	28.33	28.33	28.66	29.02	29.77	30.1	31.06	31.76
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01
BEL-20	Autocorrelation	0.18	-0.05	-0.14	-0.11	-0.05	-0.03	-0.01	-0.02	-0.08	-0.01	0.06	-0.04	0.1	0.03	0.01	0.07
	Value	8.22	8.85	14.21	17.21	17.99	18.17	18.19	18.28	19.94	19.95	20.99	21.5	24.14	24.33	24.35	25.72
	P Value	0	0.01	0	0	0	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.03	0.04	0.06	0.06
CAC 40	Autocorrelation	0.27	-0.08	-0.14	-0.1	0.03	0.01	0	-0.03	-0.1	0	0.06	-0.03	0.01	-0.01	0.01	0.12
	Value	19.03	20.54	25.66	28.54	28.77	28.79	28.79	29.06	31.7	31.7	32.59	32.76	32.78	32.8	32.82	36.58
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0
DAX	Autocorrelation	0.24	-0.06	-0.11	-0.09	-0.03	-0.03	0.09	0.03	-0.08	0.08	0.06	0.03	0.07	0.01	0	0.08
	Value	15.63	16.42	19.52	21.89	22.14	22.31	24.38	24.6	26.33	27.85	28.97	29.19	30.49	30.53	30.53	32.32
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01
FTSE 100	Autocorrelation	0.31	-0.02	-0.17	-0.16	0.01	-0.02	-0.05	-0.05	-0.07	0.03	0.02	-0.05	0.04	0.03	0.07	0.05
	Value	25.28	25.35	32.51	39.1	39.13	39.26	39.92	40.48	41.7	41.88	42.02	42.77	43.12	43.3	44.68	45.28
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stockholm General	Autocorrelation	0.28	-0.04	-0.12	-0.12	-0.01	-0.05	-0.02	-0.02	-0.12	0.06	0.14	0.06	0.05	-0.01	0.03	0.06
	Value	20.55	21.01	24.69	28.42	28.44	29	29.11	29.2	32.88	33.96	38.88	39.7	40.36	40.38	40.6	41.52
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OSE All Share	Autocorrelation	0.35	0.05	-0.08	-0.14	-0.07	-0.09	-0.06	0	-0.09	-0.01	0.07	-0.02	0.04	-0.02	0.04	0.07
	Value	31.34	32.08	33.8	39.14	40.6	42.8	43.65	43.65	45.76	45.77	46.96	47.05	47.48	47.55	48.08	49.29
	P Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swiss Market	Autocorrelation	0.23	0.01	-0.09	-0.13	0.02	-0.03	-0.02	-0.01	-0.11	0.07	0.05	-0.06	0.03	0.05	0	0.01
	Value	13.92	13.93	15.99	20.59	20.66	20.91	20.99	20.99	24.25	25.4	26.02	26.95	27.16	27.81	27.81	27.86
	P Value	0	0	0	0	0	0	0	0.01	0	0.01	0.01	0.01	0.01	0.02	0.02	0.03

Table 11: Serial Auto correlation Statistic in eighth year.

correlation coefficient are showing insignificance autocorrelation. Thus, the result of autocorrelation test of price changes in most of the cases does not supports the applicability of random walk model in order to describe share price behaviors in majority of European country indices during recent time period. Curiously all indices do not support the independence of stock prices. Thus, the overall significance of autocorrelation coefficient points to the efficiency of European markets is not in its weak form. However, it can be observed that with the increase in time lag significant auto correlated converted in insignificant. It can be said that memory related to prices decreases with increases in time period in case of few indices. One of the features of the result based on autocorrelation analysis is that this analysis overcomes the limitations of run test.

Conclusions

Thus, in most of cases the result of Run test of price changes does not supports the randomness in the stock prices because large number of country Z value are found to be significant. Run test reveals that majority of European country indices correlation coefficient is significant for the different years. It is also note that similar trends obtained even when the runs are calculated through median and mean. It is inferred that stock prices does not exhibit random behavior and thus not support the weak form of market efficiency. In run test, there is one limitation that is only sign is considered but not the absolute change. In order to overcome this limitation autocorrelation test is used in which raw value and sign are considered. Serial correlation coefficient statistics does not clearly indicates the all indices are in weak form efficiency. It indicates that majority of statistics are significantly auto correlated. The result indicates that weak form efficiency does not exist related to indices. On comparing the present study with the previous studies, it has been found that there is variation in the results of various studies. Some studies totally states that there is existence of weak form efficiency and some studies totally opposes it. The present study does not fully support either of the researchers. The results indicate that European stock market is the mixture of significant auto correlated country and insignificant auto correlated country. But majority indicts random behavior does not exist.

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