A TEST ON STOCK MARKET EFFICIENCY IN MAJOR COUNTRIES AFTER FINANCIAL CRISIS OF 2007-08

***V.Rajasekhar Ryaly, **Dr.G.V.Subba Raju**

**Asst Professor, Department of Management Studies,*
Sri Vasavi Engineering college, Tadepaligudem,West Godavari Dist,
Andhara Pradesh, INDIA
***Professor & Head of the Department , Department of Management Studies,*
Sri Vasavi Engineering college, Tadepaligudem, West Godavari Dist,
Andhara Pradesh, INDIA

ABSTRACT

Capital markets are often so sensitive to the economic issues. The performance of the stock markets largely depends on the performance of the economy. Dynamics in the economy plays a significant role to decide the market movements. The present paper is examining the efficiency of the major stock markets in the world after the financial crisis in America which erode entire world during 2007-2008. During the subprime crisis all major stock markets were deteriorated drastically. From the early sessions of the 2009 they started to recover slowly. Daily closing values of 16 major stock indices were considered for the period from 1/01/2009 to 05/31/2015 for the study of market efficiency. I considered this period was the recovery period from earlier big crunch of the economy. To test market efficiency of the indices, Random Walk Hypothesis models i.e. Runs Test, Autocorrelation test and unit root test were employed. Results obtained from the study provide the reasonable evidences to prove the weak-form of market efficiency in all selected major stock markets in the world.

Keywords: *Capital market, Random Walk Hypothesis, Weak-form of market efficiency, Stock Market, Runs Test.*

INTRODUCTION

America subprime crisis during 2006-08 left huge impact on capital markets in the world. Aftermath of the financial crisis all stock markets were drastically deteriorated. From early period of 2009 all the major stock markets were showed steady recovery. This is the right time to test the how stock markets are behaving after a huge crunch in the economy and stock market. The present study focused on understanding the efficiency of the stock markets from the selected major stock indices from Jan 2009 to may 2015. The term efficient market was introduced by the American economist Eugine Fama in early 60's. He defined market efficiency as Fama (1970) 'A market in which prices always "fully reflect" available information is called "efficient."' In generic term an efficient market hypothesis predicts that the security prices in the stock market

will fully reflected the all information available on the market. Malkiel (1992) a capital market is said to be efficient when it fully and appropriately reflects all the relevant information in determining security prices. Fama 1970, identified three level of market efficiencies, 1) weak-form of market efficiency, 2) semi-strong form of market efficiency,3) strong –form of market efficiency. These three are various intensities of availability of information. Weak-form of market efficiency states that prices of the securities are fully and instantly reflect all information of the past prices. This implies future prices are not predictable by using the past prices of the securities. Security prices are random they don't follow the pattern of old price movements. No investor has an advantage to reap abnormal return from the use this informaion. Semi strong form of market efficiency states that assets prices will fully reflect the all publicly available information. Therefore only investors with the additional inside information could have advantage on the market. Strong-form of market efficiency assets prices fully reflect the both publically and insider available information. Less developed and emerging markets are normally suitable for weak-form of market efficiency. Developed countries depends on the information technology existed on their countries they could be in semi strong kind of market efficiency. An assumption over the EMH is Fama (1991):'I take the market efficiency hypothesis to be the simple statement that security prices fully reflect all available information. A precondition for this strong version of the hypothesis is that information and trading costs, the costs of getting prices to reflect information, are always Zero. Grossman and Stiglitz (1980). A weaker and economically more sensible version of the efficiency hypothesis says that prices reflect information to the point where the marginal benefits of acting on information (the profits to be made) do not exceed marginal costs Jensen (1978). Random Walk Hypothesis (RWH) it is a financial theory stating that stock market prices evolve according to a random walk and thus can't be predictable it is consisting with the efficient market hypothesis. This paper was exploring the weak-form of market efficiency through random walk hypothesis models.

REVIEW OF LITERATURE

The concept of an efficient market has been one of the dominant themes in academic literature since 1960s. From the studies of Roberts and Osborne in 1959, Elton (1960), Noble laurite of 2013 in economics Eugene Fama. Many economists researched this market efficiency. Fame (1965) tested the market efficiency of the Dow Jones Industrial average for the period 1958 to 1962 (a period of five years) he employed serial correlation test and run test, he didn't find the linear dependency in price changes, he identified the Random Walk(RW) in the stock market prices. Ko and Lee (1991) employed serial correlation test to find the market efficiency in Japan, Hong Kong, Korea , Singapore , Twain, united states stock markets. They selected the Value of Weighted stock Index for January 1981 to December 1988. They found Strong correlation among Japan, US, Hong Kong and Singapore, Little Evidences in case of Taiwan and Korea.

Urrutia (1995) employed the variance ratio test on monthly data from December 1975 to March 1991, to check the Random Walk Hypothesis in four Latin America Stock markets, Argentina, Brazil, Chili and Mexico. Poshakwala (1996) has used the daily data of Bombay Stock Exchange from January 1987 to October 1994 to test the weak form efficiency in Indian stock market. The results of run test and the autocorrelation rejected the Weak form Efficiency.

Islam and Khaled (2005) took the daily, weekly and monthly index data from Dhaka Stock Exchange from 1990 to 2001, he employed unit root test ,autocorrelation test and Variance Ratio test to test the market weak-form Efficiency. They found evidence of Weak form Efficiency before 1996 stock market crash. Granger and Morgenstern (2007) found that there is weak form efficiency in the New York stock exchange only in short run.Venkatesan (2010) investigated the behavior of Indian stock market (NSE) returns. The study results reveal that the return series is insignificantly different from zero, which is consistent with the random Walk Hypothesis. Bin Li and Benjamin (2012) tested the Random Walk hypothesis using the Variance Ratio test in 34 MSCI countries of World Economic Outlook Database -2010. They consider the Weekly data from January 5th 1988 to December 28th 2010; they find that 25 out of the 34 markets follow Random Walk. Mohammad Ansari and Jeng ong Chen (2013) investigated the behavior of stock returns in ten major Asia-Pacific countries (Australia, China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea and Taiwan); they took the stock market closing prices covering form January 2000 to December, 2006. They employed Unit root test, Serial correlation Test, variance Ratio test, Random Walk Models BDS test. They found reasonable evidence to prove the Weak form Market Efficiency. Kapil Jain and Paryul Jain (2013) employed both parametric and non parametric test on BSE and NSE of India. He considered the closing prices from the period April, 1993 to March2013. They concluded the Indian stock market holds the weak form of market efficiency.

DATA AND METHODOLOGY

This study is based on the daily closing values of 16 major stock indices in the world those are All ordinaries (Australia), ATX (Austria), BEL20 (Belgium), IBOVESPA (Brazil), CAC40 (France), DAX (Germany), FTSE (United Kingdom), HANG SENG (Hongkong),JAKARTAII (Indonesia), NASDAQ (America), NIKKIEI (Japan), NZEX50 (New Zealand), SENSEX (India), STRAITS TIMES (Singapore), SWISS MARKET INDEX (Switzerland), TAIWAN CAPITALIZATION WEIGHTED STOCK INDEX (Taiwan), closing values of the indices was extracted from the Website http://finance.yahoo.com for the period starting from 1st January 2009 to the 31st may 2015. Daily data is specified in terms of the daily returns, considered with the first difference of the natural logarithm

$$r_t = log(p_t - p_{t-1}) \quad \textbf{(1)}$$

r_t Represents the first difference logarithm at time t, p_t is the closing price at day t, p_{t-1} closing price of the index at day $t-1$,. This study was taken with the curiosity to understand the behavior and efficiency of the major stock markets in the world after the really a world tottering subprime crisis originated in American and having their huge impact on the world stock markets during the period 2006-2008. In order to understand the market efficiency of the selected stock indices, both parametric, non-parametric tests are employed. Most traditional methods used to test the market efficiency are the Run test, Serial correlation test. Other test to find the stationary in series is Unit root test. We used runs test, serial correlation test and unit root test to check the market efficiency in selected stock markets. **Runs test** is a statistical method that examine whether a string of the data is occurring randomly in a given data or not. It analyses the occurrence of the similar events in the stream of runs. This test is used to find the occurrence of the event randomness. Formulas used for the run test are.

$$E(R) = mean\ \mu = \frac{2N_+N_-}{N} + 1 \quad (2)$$

$$Variance\ \sigma^2 = \frac{2N_+N_-(2N_+N_- - N)}{N^2(N-1)} \quad (3)$$

Whereas E(R) is the average expected return

The following hypothesis will be tested in this paper.

H0: Observed series is random.

H1: Observed series is not random.

Autocorrelation or serial correlation is the test of serial dependency. It is most common test for RWM in a form of estimates of serial correlation for stock price indices. Fama (1965), Moore (1964) Cootner (1962), Kendal (1953) calculated the serial correlation. Auto correlation test whether the coefficient of correlation are significantly different from zero, are nearly zero. The former one indicates that there is an evidence of serial correlation which indicates non randomness in series; later one implies the randomness of series. Since the tested data is daily closing prices so the leg selected for the test is 36.

$$R(\tau) = \frac{E[(X_t - \mu)(X_{t+\tau} - \mu)}{\sigma^2} \quad (4)$$

Where E is the expected period value, X_t is the value at day t, $X_{t+\tau}$ is the value at $t+\tau$,μ is the mean of the series.τ is the leg.

Testing the stationary and non stationary of the time series is the one of the way to test the market efficiency. This test is known as unit root test. This is not a significant method to test the non stationary in finance, economic time series as prices are normally not stationary. But a brief analysis was made with using this test. Most commonly used test in unit root are ADF (Augmented Dicky Fuller test), Phillip Parren test, KPSS (Kwiatkowski, Phillips, Schmidt and Shin). Presence of the unit root is the substantial evidence to prove the weak form market efficiency.

This is the formula used to test the ADF

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t \quad (5)$$

Where Δ is the first difference operator and ε_t is the zero mean white noise error term.

The null hypothesis H0: y_t contains a unit root.

H1: y_t does not contain a unit root.

If α_1 takes a negative value are any value near to significantly different from Zero in such cases the series is consider stationary.

RESULTS AND DISCUSSIONS

Before to start any study it is better to study the fundamental statistics of each time series time series variable. The following table furnished the descriptive statistics about the time series of all 16 sample indices. These statistics consists the Mean, Standard deviation, Skewness and Kurtosis.. Sample mean returns of the all stock indices ware positives and Statistical significant indicating the all stock markets was growing during the period of study 2009 to May of 2015. Indonesia stock index witnessed huge growth in their daily average returns i.e mean value of 0.0089, and followed by USA 0.078, India 0.073,Japan 0.061,Germany 0.060, Newzialnd 0.051, Taiwan 0.051, Belgium 0.045, Singapore 0.042 and brazil has 0.028 which is least average return of the study. Critical value for skewness is 0. A positive value of the skewness indicates that the series is elongated in the right tail and negative indicates that it is elongated in the left tail. The critical value of the kurtosis is 3, a value greater than 3 indicates that the series in question is peaked relative to normal, less than 3 implies that the series is flat relative to normal, Values of both skewness and kurtosis of the data series indicates that the series is not normally distributed, kurtosis values are the evidence that the there is leptokurtic distribution in the given series. So the returns are not normally distributed this is supported by the large value of the Jarque-Bera in all given series.

Table –I
Summary of the Descriptive Statistics of Daily Returns

Descriptive statistics	**Australia**	**Austria**	**Belgium**	**Brazil**	**France**	**Germany**	**UK**	**Hongkong**
Observations	1621	1591	1641	1602	1640	1636	1660	1609
Mean	0.032742	0.033932	0.045362	0.02822	0.034233	0.060015	0.032969	0.046074
S.D	0.949834	1.547543	1.193682	1.504394	1.393352	1.355684	1.056351	1.32695
Maximum	3.496558	9.099948	9.368207	6.587016	9.659285	6.072279	5.161037	7.414673
Minimum	-4.20868	-8.61745	-5.34438	-8.08514	-5.47884	-5.81852	-5.33407	-5.66051
Skewness	-0.2059	-0.12476	0.147581	0.056368	0.100115	-0.08114	-0.10307	0.104533
Kurtosis	1.417239	2.558162	3.661331	1.629269	3.070531	2.210355	2.739208	2.409826
Jarque-Bera	50.6482	224.4637	493.8009	85.4993	276.5307	101.0597	157.2795	95.5340
	Indonesia	**USA**	**Japan**	**New zeland**	**India**	**Singapore**	**Switzerland**	**Taiwan**
Observations	1565	1612	1584	1535	1579	1630	1636	1586
Mean	0.089958	0.078007	0.061933	0.051897	0.073489	0.042567	0.036553	0.05162
S.D	1.224547	1.235056	1.413439	0.619022	1.299702	0.967489	1018496	1.082743
Maximum	7.265413	7.065835	5.677639	2.774889	17.33933	5.937986	5.025038	6.742175
Minimum	-8.88036	-6.89936	-10.5539	-2.99812	-7.24705	-4.1543	-8.67127	-5.58043
Skewness	-0.2763	-0.1219	-0.44213	-0.26516	1.457955	0.379598	-0.5996	-0.21711
Kurtosis	4.528004	3.637874	3.427124	2.047077	21.11933	5.080861	6.448504	3.510281
Jarque-Bera	1840.820	208.8874	1106.7919	151.6865	2465.4724	182.6303	225.2596	356.4592

The runs test is the non parametric test to detect the statistical dependencies between observations, which may not be detected by autocorrelation test. Runs test determines whether successive price changes are random, independent and unlike serial correlation it does not require returns be normally distributed, Higgs(2004). When expected number of runs are significantly different from the observed number of runs it means the market suffers from over- or under-reaction to information, providing an opportunity to make excess returns for traders. (Poshakwale, 1996). Runs test is the non parametric test it does not require variables to be normally distributed in order to test for interdependencies. The table below was summarized the results of the runs test.

Table –II
Summary of results of Runs Test

	Australia	Austria	Belgium	Brazil	France	Germany	UK	Hongkong
Observations	1621	1591	1641	1602	1640	1636	1660	1609
Runs	814	753	811	799	863	829	833	809
Positive moves	857	816	858	802	851	880	854	816
Negative moves	764	775	783	800	789	756	806	793
Expected runs	809	796	820	802	820	814	830	805
S.D	20.05833	19.9241	20.2061	20.0062	20.2133	20.10135	20.34837	20.04583
Z VALUE	**0.257639**	-2.15677	**-0.43482**	**-0.14989**	**2.13816**	**0.731258**	**0.132393**	**0.182800**
P. VALUE	0.60	0.02	0.33	0.44	0.98	0.77	0.55	0.57
Market efficiency	Efficient	**Inefficient**	Efficient	Efficient	Efficient	Efficient	Efficient	Efficient

	Indonesia	**USA**	**Japan**	**New Zeland**	**India**	**Singapore**	**Switzerland**	**Taiwan**
Observations	1565	1612	1584	1535	1579	1630	1636	1586
Runs	771	787	830	726	758	847	791	751
Positive moves	879	906	833	861	823	845	870	856
Negative moves	686	706	751	674	756	785	766	730
Expected runs	772	795	791	757	789	815	816	789
S.D	19.47279	19.7595	19.84012	19.29233	19.8262	20.1530	20.1358	19.78031
Z VALUE	-0.0307794	-0.3842	1.91887	-1.61253	-1.5675	1.59302	-1.22639	-1.92085
P. VALUE	0.49	***0.35***	**0.98**	***0.05***	***0.06***	***0.94***	***0.11***	***0.03***
Market efficiency	Efficient	Efficient	Efficient	Efficient	Efficient	Efficient	Efficient	Efficient

From test results except Austria all the other countries stock indices are not rejected the null hypothesis at the 5% significant value of $\pm$1.96 any value between +1.96 to -1.96 will sufficient to adjudge that the observed series is random doesn't have sequence of runs .Significant value of P for two tail test is 0.025 any value below 0.025 are significant for the study , more than 0.025 is considered as the insignificant of the test. Austria has z value of -2.1567,P-value 0.02 reject the null hypothesis, it indicates that observed series was not followed the randomness. For the other countries I found the reasonable evidences to prove randomness in the observed series, difference between the expected runs and observed runs are very less. Finally I conclude that except the Austria all other 15 stock markets have the weak form of market hypothesis.

Autocorrelation (serial correlation) is the test of serial dependency. Serial dependency is the most common test for RWH (Random Walk Hypothesis). Autocorrelation test the evidence whether the coefficient of correlation are significantly different from zero. (Granger, 1969)If there is any correlation in the residual series it is likely the first order serial correlation between E_t and $E_{t-1.}$ As per this we need to correlate the same series between Et and $E_{t-n,}$ n is the number of legs. For instance there is 16 leg correlation the variable need to check the serial dependency between E_t and $E_{t-16.}$ Fama 1965, test the autocorrelation in Dow Jones Industrial average. He found the coefficient value 0.003 this value is significantly near to zero with this he concluded that the market has a serial independence. Kendal (1953), Moore (1964), and Cootner (1962) test the serial correlation for the daily and weekly returns. Serial correlation for the large sample size(large time series) and high order serial correlation Ljung- Box statistics is used. If the autocorrelation and partial correlation values at all legs are zero or nearly zero there is no serial correlation, and the values of Ljung- Box statistics values should be insignificantly large. We have been conducted the autocorrelation for the 36 legs performed on the entire data series.

The details of the autocorrelation results were given in the Table –II for 36 legs along with the Ljung- Box statistics. Auto Correlation coefficient column represents the values of the correlation coefficient for all 36 legs, values of this were the significantly near to zero in all markets for some legs this values are equal to zero. From this evidence we can say all these stock markets have no serial correlation it implies that we con't reject the null hypothesis (serial independence) all markets are efficient market the form of efficiency is weak-form efficiency. This is supported by the higher value of Ljung- Box statistics.

Table-III

Summary of Results of Autocorrelation of Daily Retunes

leg	Ausrtalia	Austria	Belgium	Brazil	Fances	Germany	UK	Hongkong
				Autocorrelation with 36 Legs				
1	0.0134*	0.0818	0.0235*	-0.0269*	-0.0166 *	0.0140*	0.0073*	0.0184*
2	0.0247*	-0.0322*	-0.0222*	0.0111*	-0.0222*	-0.0068*	-0.0125*	0.0120*
3	-0.0172*	-0.0340*	-0.0239*	-0.0352*	-0.0199*	-0.0090*	-0.0244*	0.0048*
4	-0.0332*	-0.0352*	-0.0689	0.0127*	0.0288*	-0.0090*	-0.0210*	-0.0372*
5	-0.0258*	-0.0255*	-0.0430*	-0.0015*	-0.0129*	-0.0325*	-0.0047*	0.0089*
6	0.0245*	-0.0008*	0.0045*	-0.0345*	0.0278*	0.0279*	0.0118*	-0.022*
7	0.0201*	0.0140*	0.0290*	-0.0195*	0.0175*	0.0128*	0.0039*	0.0381*
8	-0.0058*	-0.0120*	-0.0513	0.0117*	-0.0264*	-0.0027*	-0.0416*	0.0015*
9	-0.0247*	-0.0232*	-0.0038*	-0.0126*	-0.0173*	-0.0062*	-0.0064*	0.0217*
10	0.0160*	0.0368*	0135*	0.0041*	-0.0202*	0.0114*	-0.0017*	-0.0278*
11	-0.0196*	0.0387*	0.0034*	0.0052*	0.0047*	0.0372*	-0.0066*	-0.0280*

12	0.0118*	-0.0181*	0042*	-0.0101*	-0.0012*	-0.0081*	-0.0159*	-0.0145*
13	-0.0005*	0.0591*	0.0176*	-0.0058*	0.0112*	-0.0214*	0.0456*	0.0078*
14	-0.0006*	-0.0422*	0.0124*	-0.0460*	-0.0186*	-0.0193*	-0.0328*	-0.0279*
15	-0.0332*	-0.0259*	-0.0110*	0.0320*	-0.0052*	-0.0019*	-0.0139*	-0.0048*
16	-0.0112*	0.0154*	0.0125*	0.0202*	0.0082*	-0.0011*	-0.0224*	0.0044*
17	-0.0213*	0.0341*	0.0502	-0.0024*	0.0486	0.0367*	0.0386*	0.0014*
18	-0.0116*	-0.0438*	-0.0369*	-0.0338*	-0.0338*	-0.0305*	-0.0471*	-0.0298*
19	-0.0154*	0.0184*	0.0135*	0.0124*	-0.0050*	-0.0301*	-0.0305*	0.0012*
20	-0.0466	0.0023*	-0.0048*	0.0502	-0.0227*	0.0046*	-0.0134*	0.0111*
21	0.0296*	0.0375*	0.0150*	-0.0218*	0.0010*	-0.0062*	-0.0257*	0.0026*
22	-0.0393*	0.0017*	0.0285*	-0.0099*	-0.0039*	0.0040*	-0.0080*	-0.0263*
23	-0.0005*	-0.0170*	.0298*	-0.0105*	0.0302*	0.0184*	-0.0184*	-0.0131*
24	-0.0321*	-0.0454*	-0.0100*	-0.0107*	-0.0235*	-0.0224*	-0.0240*	-0.0263*
25	-0.0015*	0.0573	0.0156*	-0.0117*	0.0188*	0.0266*	0.0235*	-0.0268*
26	0.0071*	0.0443*	-0.0047*	0.0011*	-0.0161*	-0.0026*	-0.0267*	0.0326*
27	-0.0161*	-0.0204*	0.0149*	-0.0032*	-0.0162*	0.0042*	0.0098*	-0.0135*
28	0.0045*	-0.0437*	-0.0034*	0.0246*	-0.0175*	0.0039*	-0.0084*	0.0099*
29	-0.0059*	0.0160*	0.0099*	0.0101*	0.0016*	-0.0161*	-0.0092*	-0.0394*
30	-0.0203*	0.0162*	0.0271*	0.0139*	0.0365*	-0.0111*	-0.0203*	0.0223*
31	0.0476	-0.0064*	0.0057*	0.0092*	0.0017*	0.0057*	-0.0316*	0.0041*
32	-0.0389*	0.0099*	0.0060*	0.0251*	-0.0027*	-0.0000*	0.0126*	0.0209*
33	0.0127*	0.0262*	-0.0059*	0.0108*	-0.0200*	0.0058*	0.0094*	0.0222*
34	-0.0061*	-0.0165*	-0.0357*	0.0012*	-0.0171*	-0.0431*	-0.0147*	-0.0023*
35	0.0687	-0.0314*	0.0191*	-0.0246*	0.0194*	0.0002*	0.0129*	0.0567
36	-0.0035*	0.0030*	-0.0536	-0.0008*	-0.0410*	-0.0248*	0.0063*	-0.0283*
L&B	36.9512	61.6633	39.7743	24.2043	26.0068	20.4920	28.1773	30.3821
P-Value	0.4501	0.0057	0.3231	0.9383	0.8903	0.9843	0.8311	0.7513

*5%singinificant level

Table-IV

Summary of Results of Autocorrelation of Daily Retunes

leg	Indonesia	USA	Japan	Newzeland	India	Singapore	swizerland	Taiwan
Autocorrelation with 36 Legs								
1	0.0413*	-0.0295*	-0.0464*	0.0662	0.0770	0.0278*	0.0609	0.0844
2	0.0013*	0.0103*	0.0474*	-0.0152*	-0.0297*	0.0345*	-0.0202*	-0.0452*
3	-0.1190	-0.0485*	-0.0066*	0.0187*	-0.0325*	0.0118*	-0.0182*	-0.0188*
4	-0.0790	-0.0110*	-0.0570	0.0058*	-0.0045*	-0.0038*	-0.0081*	-0.0191*

5	0.0157*	-0.0317*	0.0309*	0.0006*	0.0124*	0.0098*	-0.0315*	0.0020*
6	-0.0566	-0.0225*	0.0172*	0.0203*	-0.0004*	-0.0037*	0.0470*	-0.0471*
7	0.0490	0.0026*	-0.0072*	0.0158*	-0.0099*	0.0419*	-0.0250*	0.0241*
8	0.0151*	0.0138*	0.0204*	0.0466*	-0.0098*	-0.0337*	-0.0411*	-0.0041*
9	0.0193*	-0.0353*	0.0159*	-0.0046*	0.0239*	0.0206*	0.0181*	0.0272*
10	0.0225*	0.0635	-0.0303*	0.0033*	-0.0049*	0.0151*	-0.0117*	0.0006*
11	-0.0224*	-0.0126*	-0.0340*	0.0123*	-0.0155*	-0.0517	0.0036*	-0.0185*
12	0.0773	-0.0275*	-0.0347*	0.0223*	0.0055*	0.0356*	-0.0276*	-0.0164*
13	-0.0475*	-0.0258*	0.0388*	-0.0351*	-0.0078*	-0.0123*	-0.0155*	0.0340*
14	0.0128*	-0.0107*	-0.0049*	-0.0352*	0.0093*	-0.0028*	0.0027*	0.0428*
15	-0.0471*	-0.02532*	0.0186*	-0.0431*	-0.0116*	0.0029*	-0.0133*	-0.0458*
16	-0.0179*	0.0170*	-0.0046*	0.0097*	0.0065*	-0.0129*	-0.0052*	-0.0257*
17	-0.0092*	0.0310*	-0.0077*	0.0169*	0.0592*	0.0258*	0.0303*	-0.0017*
18	-0.0330*	-0.0444*	-0.0322*	-0.0209*	-0.0002*	-0.0594	-0.0458*	0.0172*
19	0.0026*	-0.0084*	-0.0161*	-0.0157*	-0.0012*	0.0229*	-0.0106*	0.0128*
20	0.0206*	0.0049*	0.0263*	-0.0072*	-0.0509	0.0140*	-0.0331*	0.0124*
21	0.0090*	0.0058*	-0.0216*	0.0495*	-0.0266*	-0.0068*	-0.0123*	-0.0054*
22	-0.0279*	-0.0464*	0.0023*	-0.0058*	-0.0361*	-0.0011*	-0.0201*	-0.0264*
23	-0.0576	0.0252*	-0.0359*	-0.0366*	-0.0636	0.0023*	-0.0019*	-0.0384*
24	0.0368*	0.0111*	0.0032*	0.0008*	-0.0074*	-0.0132*	-0.0255*	-0.0055*
25	-0.0072*	-0.0815	0.0064*	-0.0058*	-0.0085*	-0.0315*	0.0157*	-0.0190*
26	0.0533	-0.0093*	-0.0425*	-0.0059*	-0.0006*	0.0085*	-0.0027*	0.0505
27	0.0464*	-0.0014*	-0.0111*	0.0345*	-0.0308*	-0.0224*	0.0052*	-0.0018*
28	0.0074*	0.0061*	0.0062*	0.0063*	-0.0303*	-0.0022*	0.0002*	0.0002*
29	0.0015*	0.0141*	-0.0148*	-0.0195*	-0.0039*	-0.0404*	0.0369*	-0.0613
30	-0.0105*	-0.0168*	0.0050*	-0.0083*	0.0284*	-0.0568	-0.0363*	-0.0159*
31	0.0244*	0.0066*	-0.0256*	0.0158*	-0.0073*	0.0189*	0.0050*	-0.0008*
32	-0.0909	-0.0450*	-0.0270*	0.0111*	0.0010*	0.0036*	-0.0050*	-0.0005*
33	-0.0659*	-0.0161*	-0.0063*	0.0607*	0.0170*	-0.0138*	0.0241*	0.0383*
34	-0.0037*	0.0037*	0.0125*	0.0413*	0.0703	0.0080*	0.0278*	-0.0340*
35	0.0561	-0.0204*	-0.0177*	-0.0224*	-0.0237*	0.0116*	-0.0248*	-0.0159*
36	0.0042*	0.0118*	-0.0070*	-0.0102*	-0.0078*	-0.0106*	-0.0094*	0.0505
L&B	109.4999	46.2649	36.1108	40.241	47.0998	34.9281	34.4731	54.3624
p-val	0.2567	0.1175	0.4635	0.2879	0.1134	0.5194	0.5413	0.0254

*5%singinificant level

Unit root testing is an important test whether data is stationary or not. If there is no fixed level of price then the time series is non stationary. It is necessary but not significant condition for the

Random walk Hypothesis. A series is said to be stationary if the mean and covariance of the series do not depend on time. To test the Presence of the unit root augmented Dickey Fuller (ADF) test is the famous test. We applied ADF, KPSS (Kwiatkowski, Phillips, Schmidt and Shin). Details of unit root test ware furnished in the table- IV, which were the value of variance values at first differences, first differences is measured in the series with $X_t - X_{t-1}$, where X_t is the closing price of the index at day t, X_{t-1} is the closing price at day t-1

Table -V

Summary of results of UNIT ROOT TEST at variance of first difference

Unit root test	**Null hypothesis : series has a unit root**			**Null hypothesis : Series is stationary**		
	Augmented Dickey Fuller test t-			KPSS test		LM-
	Test	1% level	-2.5657	Asymptotic	1%level	0.739
		5% level	-1.9409		5% level	0.463
		10% level	-1.6166		10% level	0.347
	*Mac Kinnon (1996) one sided P-value			*KPSS(1992, table)		
Australia	ADF t- -22.674 (*Prob : Rejected)			KPSS	0.0640*(Donot Reject)	
Austria	ADF t- -23.542 (*Prob : Rejected)			KPSS	0.0759*(Donot Reject)	
Belgium	ADF t- -23.596 (*Prob : Rejected)			KPSS	0.1518*(Donot Reject)	
Brazil	ADF t- -23.781 (*Prob : Rejected)			KPSS	0.1733*(Donot Reject)	
Fance	ADF t- -23.854 (*Prob : Rejected)			KPSS	0.0954*(Donot Reject)	
Germany	ADF t- -22.679 (*Prob : Rejected)			KPSS	0.2019*(Donot Reject)	
UK	ADF t- -23.676 (*Prob : Rejected)			KPSS	0.0272*(Donot Reject)	
Hongkong	ADF t- -22.375 (*Prob : Rejected)			KPSS	0.0842*(Donot Reject)	
Indonesia	ADF t- -25.174 (*Prob : Rejected)			KPSS	0.1133*(Donot Reject)	
USA	ADF t- -23.742 (*Prob : Rejected)			KPSS	0.0891*(Donot Reject)	
Japan	ADF t- -22.434 (*Prob : Rejected)			KPSS	0.3069*(Donot Reject)	
Newzeland	ADF t- -21.514 (*Prob : Rejected)			KPSS	0.2913*Donot Reject)	
INDIA	ADF t- -22.990 (*Prob : Rejected)			KPSS	0.1058*(Donot Reject)	
Singapore	ADF t- -21.537 (*Prob : Rejected)			KPSS	0.2131*(Donot Reject)	
Swizerland	ADF t- -22.761 (*Prob : Rejected)			KPSS	0.0872*(Donot Reject)	
Taiwan	ADF t- -22.899 (*Prob : Rejected)			KPSS	0.1622*(Donot Reject)	

The test of unit root was performed on first difference of the data series on all the indices . Mac Kinnon's(1996) critical values are used to determine the significance of the test statics. ADF test was made with intercept. Test performed in levels reject the null hypothesis. ADF test rejected

the null hypothesis in all H0 in all the countries, Implies that the first difference provided the evidences for stationary in data and data rejects unit root for all series. So it indicates that all markets are weak form of market efficiency. On the other side null hypothesis of the KPSS have reverse assumptions that series has no unit root. If hypothesis is not rejected it indicates that the data is stationary. Daily returns of the stock index of the five countries provide that all are weak form efficient (null hypothesis is not rejected KPSS, in case of all selected countries) Form the table we can conclude that all the countries have market efficiency.

CONCLUSION

This study examines the efficiency of major stock markets in the world. 16 stock indices was considered for the study. The period of study was chosen from 2009-2015 considered as the recovery period from early aftermath of financial crisis in the world during 2007-08 originated in America as of subprime crisis left a huge impact on capital markets. Sample indices selected for the study were, All ordinaries (Australia), ATX (Austria), BEL20 (Belgium), IBOVESPA (Brazil), CAC40 (France), DAX (Germany), FTSE (United Kingdom), HANG SENG (Hongkong), JAKARTAII (Indonesia), NASDAQ(America), NIKKIEI (Japan), NZEX50 (NewZealand), SENSEX(India), STRAITS TIMES (Singapore), SWISS MARKET INDEX (Switzerland), TAIWAN CAPITALIZATION WEIGHTED STOCK INDEX (Taiwan). Both parametric and nonparametric test were applied to find the evidences of the market efficiency during the period of study. Runs test, serial dependency (autocorrelation test), and unit roots test (ADF Augmented Dicky Fuller Test, KPSS (Kwiatkowski, Phillips, Schmidt and Shin) were used. Results obtained from the application of the tests reflects that the all major stock markets are showing a steep recovery, growth from the huge slump, losses during 2007-08. Non parametric runs test indicates the insignificance serial dependency in all the major secondary markets except Austria. All the other major stock markets does not reject random walk hypothesis and shows increased efficiency. Autocorrelation provide the same outcome. All indices were insignificant to the serial dependency. So martingale hypothesis was not rejected. The required conditions for random walk models of unit root test were rejected for sample indices.

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