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An Empirical Study: Weak form of Efficiency test on Dhaka Stock Exchange (DSE) Based on Random Walk Hypothesis Model

Ahmed Raihan Sadat[1]
[1](*Lecturer in Finance, Department of Business Administration in Finance and Banking, Bangladesh University of Professionals, Bangladesh)*
Corresponding Author: Ahmed Raihan Sadat

Abstract: *This paper investigates the market efficiency in weak form by employing RWH model on returns taken from the daily, weekly, and monthly data of DSE indices, DS30 and DSEX, which were introduced in the beginning of 2013. The time series analysis is conducted based on five years (approximate) of time period with above 1300 observations in total. After initial descriptive statistics test (Jarque Bera), return series found to be not normally distributed, hence, non-parametric testing method is used. According to Unit root test (Phillips and Perron) data has unit root, which suggests that return series are stationary in nature. The paper concluded that DSE data does not follow a random walk. Meaning, market is not efficient in weak form. Therefore, it can be said that investors functioning in DSE can make above average return by using investment strategies and DSE market do not reflect the rational and appropriate price of the stocks.*

Keywords: *Dhaka Stock Exchange, non-parametric test, Random walk hypothesis model, weak form efficiency*.

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I. Introduction

In this current world, one of the most important measurement of economic development is the capital market, which transports capital towards its best economic use and keep the productive actions running. One of the major requirements of a healthy capital market is, it needs to be efficient. Hence, developing countries like Bangladesh, the topic of market efficiency has grabbed enormous attention to both practitioners and academics.

The term EMH first introduced by Bachelier (1990), which means the price of equity must reflect all available information in the market. The classification of EMH namely, weak, semi strong, and strong was developed firstly by Professor Eugene Fama in 1960 and named as EMH (efficient market hypothesis). This paper tests DSE in weak form of efficiency, which means current security prices fully and instantaneously reflects all relevant information in past trading records.

This research contributes to the existing literature in this subject area and test the efficiency of DSE for a certain period of time with some combination of tests. In an efficient market equity is priced with precision and without distortion, which we say the accurate intrinsic value, thus, reducing the chance of making unhealthy gains from investment strategies. Therefore, no market participants can use historical data to predict future value.

Research objectives

1. To test market efficiency of DSE in weak form based on random walk hypothesis model.
2. To test price dependency on previous period prices.
3. To test stationarity in data.

II. Literature review

2.1 Market efficiency

A market is called efficient when at any point of time the share price fully reflect all available information regarding the stocks and price of the share equals to the true worth of the share, thus, no market players can gain excess return through using any secret information of any type (Fama, 1970). However, Fama agreed to the fact that this hypothesis cannot give cent percent accuracy, instead can be used as a benchmark to evaluate market performance at any given time. Market efficiency also indicates that there is large number of traders actively pursuing to forecast future price from freely available information in the market (Fama, 1965). The basic classification of EMH contains three types namely, weak form efficiency – information about the historic prices of the assets (price changes follow a random walk), semi-strong form efficiency –information known to all market participants that are the publicly available information about company's past performance and future prospect, and strong form efficiency – information that are known to any market participants, which private information such as, company's policies and plans (Fama, 1970; Fama, 1991). EMH also implies that it

is not possible to predict future changes in share price from public information; instead, market perception regarding that company's value of wealth can move the stock price (NWOSA & OSENI, 2012).

Evidence of critique regarding the assumptions of EMH is significant. Critics argued this hypothesis to be unstable and even impossible in some cases. The term it uses 'fully reflect' information is vague itself (Guerrien & Gun, 2011). Efficiency of market also includes the risk preference of investors; therefore, any study of EMH should consider both the market efficiency and investors risk preference. Thus, the EMH itself cannot be considered as an empirically refutable hypothesis (Beja, 1977). Furthermore, investors need to consider cost to get information, therefore, all market information is not freely available to traders in a balanced manner as traders have limitation and difference of their ability to spend on getting those information, leading to conclusion that it indeed is an unstable and impossible concept of finance(Grossman & Stiglitz, 1980; Tirole, 1982).

Although EMH has many undoubted shortcomings, however, critics' claiming it to be the reason of worldwide crisis is not justified as even before the EMH concept evolved the world has faced several stock market bubble incidents such as, 1720 South Sea Company Bubble, 1926 Florida Land Bubble etc.(Ball, 2009).Despite of much criticism on EMH it is considered as one of the strongest hypotheses in the field of social science. Until a replaceable and less defected hypothesis is discovered, criticism is to some extent pointless (Sewell, 2012). Therefore, EMH is firmly stated as a durable theory (and likely to continue so) of capital market despite of its notable flaws (Ball, 2009).

2.2 Empirical research evidence

Many researchers have conducted studies in different parts of the world focusing on EMH and RWH to test the market efficiency of certain stock markets. Likewise, Bangladesh stock market viz. Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE) was also a point of focus to many researchers both home and abroad. Some of the relevant ones, which test weak form of market efficiency for both Bangladesh and abroad are discussed here:

14 Asia-pacific country's (Pakistan, India, Korea, Hong Kong, Indonesia, Malaysia, Philippine, Singapore, Thailand, Japan and Australia) stock markets were tested taking monthly observations from the period of 2004 – 2009 (Hamid, et al., 2010). First, they have calculated monthly return of data series and tested normality in data distribution using Jarque-Bera statistics, which is a very common and popular one. They have found data is normally distributed for 11 countries. Second, they have used serial correlation, using Ljung-Box Q-statistics test, to see the randomness or dependence. Apart from Pakistan from 6 lag onwards, all the countries have failed to prove random, hence, declared market efficiency do not hold. Finally, to test stationarity, unit root test is applied on data series using ADF test. Findings of ADF is, non-stationary at order I(0) and it becomes stationary for order I(1) at 1% and 5 % level of significance. To test random walk hypothesis (RWH), run test in applied and all markets clearly rejected null hypothesis, which is data series follows a random walk.

In other research (Rahman, et al., 2016), they have used daily returns for the period of 2006 – 2015 to test market efficiency of CSE (Chittagong Stock Exchange). They have divided the tests into two segments viz. parametric and non-parametric tests. Researchers have tested if CSE follows random walk or not. Under parametric test, unit root test and ACF test are applied. Under non-parametric test, run test, variance ratio test, and Kolmogorov Smirnov Goodness of Fit Test are used (to test the normal distribution of data). Results of ADF shows data to be non-stationary, thus, random walk hypothesis is rejected. In L-B Q statistics test to check the unit root in data, CSE found to be inefficient. Likewise, run test also suggest the same thing, CSE doesn't follow a random walk, hence, market is not efficient in weak form. To further confirm the result, more powerful test, variance ratio test, is used, however, results were not different in this case too.

Another researcher took monthly data series for the period of 1980 – 2008 to test weak form of efficiency of DSE (Joarder, et al., 2014). This research used unit root test to see if data follows random walk. This test examines both random walkness and stationarity of the data series (stock prices). Researchers have also applied ADF test to check the efficiency level in market. All the test results rejected null hypothesis, which is DSE is not an inefficient market in weak form, hence, stock prices do not fully reflect all the available rational information. This researchers have suggested some improvement measures too in the paper such as, SEC should be modernized, revaluation of the net asset value (NAV) of the companies should be performed by the affiliated firms of the SEC, demutualization, strict monitoring of insider trading etc.

In 2015, five Asian stock markets were studied namely, Hong Kong, Taiwan, Korea, Pakistan, and India where data collected from 2000 – 2012 on daily basis (Shaheen, et al., 2015). First, they have calculated the return and conducted descriptive statistics test using Jarque Bera test. This research incorporates both the tests of EMH and RWH. To test random walk they have employed ADF and serial correlation (L-B Q statistics) and found market do not follow random walk. For Karachi, Bombay, and Taiwan stock markets, till lag 10, in all cases P value is less than .05, which rejects null hypothesis (market is inefficient). On the other hand, in Korean stock exchange, P value is more than .05 in all the lags till lag 10. Which means, market is efficient. In

Hong Kong they found a mixture, in some lags it rejects and in some lags it accepts the null hypothesis, therefore, in totality they have rejected the null hypothesis. Later, unit root test is employed to see stationarity in data and found data is stationary at level I (0) with the critical values of 1%.

(Hasan, et al., 2011), this research conducted the study based on 94 listed companies during the period of 2000-2008. Interestingly, it was observed that the inefficiency increased over the reference period. That means, market is not efficient. And the inefficiency gets higher with increased time period. That means, more data getting into, predictors (investors speculating) can predict more precisely and get uneven advantage over other investors by gaining extra profit from that investment.

Some research have sub-divided the time period to get more insights from the findings. One of these type was conducted in 2012 (Chaity & Sharmin, 2012). They have correctly mentioned and classified the timeline (1993 – 2011 and 2002 – 2011) based on two market crashes that DSE faced in 1996 and 2010. This research also discusses how effective the government initiatives were in encountering the market crushes during that time. This study took daily observations from stock market data and focused on testing weak form of EMH and RWM of DSE by calculating the daily return using logarithm. To test normality in data, they have used Kolmogrov-Smirnov Goodness of Fit test and conducted Q-Q probability chart and found data not to be normally distributed. They have used ACF and PACF to test the random walk hypothesis and applied Ljung–Box test in Auto Regressive Integrated Moving Average (ARIMA) modeling. They found significant positive auto correlation presence on first lag for both indices, which means data do not follow random walk. Furthermore, ARIMA (time series) forecasting strengthens the non-random nature of Dhaka stock Exchange. Another timeline sub-division based study was conducted with Karachi Stock Exchange (KSE) in 2013 (Rabbani, et al., 2013). They have applied ADF test and found unit root, suggesting weak form of inefficiency in KSE of Pakistan.

In the study conducted in 2013 (Khan & Huq, 2013), they have tested DSE efficiency for the period of 2002 – 2010 using both parametric and non-parametric tests. What they did different from the others is, along with the indices of Bangladesh stock exchange they have incorporated 12 randomly selected listed companies to avoid thin trading bias. They have sub-segmented the timeline in 2002-2004, 2005-2007, 2008-2010 to test the robustness of the empirical findings. Under parametric tests, autocorrelation test, unit root test, and ARIMA model are used. Under non-parametric, run test is used. Results say, stock market return series has dependence, data has no unit root (stationary), DSE data do not follow random walk, and returns can be predicted by using time series model like ARIMA. Therefore, they have concluded that DSE in not efficient in weak form. Same parametric and non-parametric approach is also used in some other research (Hasan, 2015). Although the researcher did not divide the timeline but has taken same approach to evaluate random walk hypothesis and market efficiency. Results from this study also shows, none of the indices of DSE follow random walk, and thus, market is inefficient.

To test the efficiency in weak form for CSE data was taken from 2006- 2016 on daily basis (Hussain, et al., 2016). They have used both parametric (autocorrelation coefficient test, L-B Statistics) and non-parametric test (run tests). Results of run test, autocorrelation and L-B statistics tests shows, CSE do not follow random walk. Overall they have suggested, CSE is not weak form of efficient market.

Some other researches were also conducted focusing on DSE based on similar parametric and non-parametric test. Almost in all the cases (with insignificant exceptions for some sub-divided periods) market is found to be not efficient and not following random walk hypothesis (Khandoker, et al., 2011) (Raquib & Alom, 2015) (Bayezid Ali, 2012).

2.3 Literature gap

In all of the above discussed literature, studies conducted on DSE, CSE, or stock exchanges worldwide, we can see many methods and combination of methods to test market efficiency and random walk hypothesis. Literature gap is thin but when we talk about Bangladesh capital market, more specifically DSE, the gap can be found with precision. Researchers did not always applied all daily, weekly, and monthly data. Besides, not all parametric and non-parametric tests were conducted. Most importantly, the new indices, DSEX and DS30, that DSE follows now is barely used in any of the existing literature. Therefore, the inclusion of testing market efficiency and random walk hypothesis with two new indices will add value to existing literature in this arena of study for DSE.

III. Methodology

3.1 DSE Orientation

Bangladesh stock market, consists of two stock exchanges, viz., Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE), is on the rise. They both are separate corporate entities under the Companies Act 1994. This research is entirely focused on Dhaka Stock Exchange (DSE). DSE was established in 1954. However, the operation started in 1956. In 1958 it shifted to Dhaka from Narayangonj. After the independence

of Bangladesh in 1971 DSE ceased operation and started to operate again in 1976 with new government policies. The activities of DSE is regulated by its Articles of Association rules & regulations and by-laws along with the Securities and Exchange Ordinance - 1969, Companies Act - 1994 & Securities & Exchange Commission Act - 1993. DSE has a total of 573 listed companies traded each day. DSE already offers equity (shares), mutual funds, corporate bonds, treasury bonds and debentures.

3.2 Data, methodology and hypotheses development

This research uses secondary data from DSE website. Firstly, data has been collected from two indices DSEX and DS30 on daily, weekly, and monthly basis. Secondly, daily, weekly, and monthly closing index values are used to calculate the daily, weekly, and monthly returns to run all the statistical tests. Then, data has been tested for normal distribution (descriptive statistics). This research consists data from 28/01/2013 to 08/08/2018, total of almost 5 years, more precisely, 1340 observations. This is understandable that, data set should accumulate for a longer period of time, but the indices are comparatively new, hence, data has been collected from the inception of these two indices. After taking the data first the returns of the index prices are taken through the following calculation:

$$R_t = \ln(\frac{P_t}{P_{t-1}})$$

Where,
P_t = present value of index at time "t"
P_{t-1} = index price one period before the current price

To identify the type of data, Jarque-Bera test has been used. The Jarque Bera test was employed to check the risk, return and normality of the data with the following equation:

$$JB = n.\left[\frac{S^2}{6} + \frac{(EK)^2}{24}\right]$$

Where,
S= skewness of data
EK = Excess kurtosis of the data
n = sample size

Hypothesis tested will be:

H_0: Data of return series is randomly or normally distributed
H_1: Data of return series is not randomly or normally distributed

After evaluating the descriptive statistics, unit root test (Phillips and Perron) is employed to test the primary hypothesis of the research. The prime investigation of this research is to test the following hypothesis:

H_0: prices on the DSE follow a random walk
H_1: prices on the DSE do not follow a random walk

3.3 Unit root test (P-P test)

Phillips and Perron (1988) developed a number of unit root tests that have become popular in the analysis of financial time series. The Phillips-Perron (PP) unit root tests differ from the ADF tests mainly in how they deal with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric auto regression to approximate the ARMA structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression. The test regression for the PP tests is:

$$\Delta y_t = \boldsymbol{\beta}' \mathbf{D}_t + \pi y_{t-1} + u_t$$

Where, u_t is I (0) and may be heteroskedastic.

The hypothesis that is tested in Unit root test will be:

H_0: return series of index has a unit root
H_1: return series of index has no unit root

IV. Results and Analysis

4.1 Jarqua bera test of normality (descriptive statistics)

From the results of Jarque-Bera test on both the returns of indices DSEX and DS30, we can see that the significance value is below .05, which means the data series is not normally distributed or data do not follow a normal distribution. Besides, the skewness and Kurtosis values also deviates in wider scale than ideal or standard of normally distributed data. Therefore, parametric tests are not used in this research because, one of the assumptions of parametric test is that data has to be normally distributed. The study is based on unit root test (Phillips and Perron), which is a non-parametric test. Table 1 below represent the summary of descriptive statistics.

Table 1: Summary of descriptive statistics

Statistics	DS30			DSEX		
	Daily	Weekly	Monthly	Daily	Weekly	Monthly
Mean	.000199	0.000673	0.000861	0.000215	0.000688	0.000271
Median	0.000126	0.000614	.001358	0.000149	0.000998	0.000808
Maximum	.051738	0.024348	0.024348	0.03847	0.021376	0.019588
Minimum	-0.05089	-0.02594	-0.018945	-0.053584	-0.024160	-0.025198
Std. Deviation	0.008772	0.007219	0.007777	0.008247	0.006703	0.007601
Skewness	-0.03097	-0.16563	0.026897	-0.105431	-0.305797	-0.457626
Kurtosis	6.874849	4.446604	3.543546	6.406510	4.424262	4.003633
Observations	1339	285	66	1339	285	66

4.2 Unit root test (Phillips and Perron)

The unit root test results for both return series, DS30 and DSEX, are same, in terms of sig. value, in all time frame (daily, weekly, monthly). In all the cases the data is stationary at level (see appendix A for details of test results). They suggest return series have a unit root, which accepts the null hypothesis of unit root test. Data is stationary, which means the return series behave persistently over the time and can be predicted or forecasted. Investors can use different trading strategies to achieve above average return from the market of DSE. Summary of unit root test results are mentioned in table 2 below.

Table 2: summary of unit root (P-P) test

Indices	Time frame	Unit root	P-P test statistics	Sig. value
DS30	Daily	Has a unit root	-33.22534	0.0000
	Weekly	Has a unit root	-15.83192	0.0000
	Monthly	Has a unit root	-9.825309	0.0000
DSEX	Daily	Has a unit root	-32.74995	0.0000
	Weekly	Has a unit root	-16.35817	0.0000
	Monthly	Has a unit root	-9.239693	0.0000

V. Analysis of Results and Conclusion

The study consists of two currently available indices of DSE, which are DS30 and DSEX. Examination of daily, weekly, and monthly data has been collected. The return series of all daily, weekly, and monthly have been collected and tests were conducted. The return series data are not normally distributed, hence, non-parametric test (P-P) is used. The research was conducted based on Phillips and Perron Unit root test. In all the cases in different time frame data found to be stationary. Which rejects the primary hypothesis of this research paper that is prices of DSE do not follow a random walk (RWH). That means, any investor can gain above average return from investment in DSE using different investment strategies. The results also suggest that Dhaka Stock Exchange is not an efficient market. Data are not available to all the investors at same time and market price of DSE do not reflect all the necessary market information, hence, people rely on past information instead of acting on real time current information about the companies enlisted in DSE.

However, the drawback of concluding the results based on the test is the time frame taken. Time series analysis should consist of more than five years. However, this was not possible because the currently available indices have started to keep records dated from January 2013 (which is the starting point of collected data). This demerit, on the other hand, adds value to the literature of market efficiency of DSE because not many researchers have conducted the efficiency tests on DSE based on DS30 or DSEX index return series. Further analysis can be conducted using other stationarity tests after making the data series normally distributed.

References

[1]. Fama, E. F., 1970. Efficient capital markets: A review of theory and empirical work. *Journal of Finance, 25(2),* pp. 383-417.
[2]. Fama, E., 1965. Random Walks in Stock Market Prices. *Financial Analysts Journal, 51(1),* pp. 75-80.
[3]. Fama, E. F., 1991. Efficient Capital Markets. *The Journal of Finance, 46(5),* p. 1575–1617.
[4]. NWOSA, P. I. & OSENI, I. O., 2012. Efficient Market Hypothesis and Nigerian Stock Market. *Research journal of Finance and Accounting, 2(12*), pp. 38-46.
[5]. Guerrien, B. & Gun, O., 2011. Efficient Market Hypothesis: What are we talking about?. *real-world economics review,* Volume *56,* pp. 19-30.
[6]. Beja, A., 1977. *The limits of price information in market processes,* Berkeley: University of California.
[7]. Grossman, S. J. & Stiglitz, J. E., 1980. On the impossibility of informationally efficient markets. *The American economic review, 70(3),* pp. 393-408.
[8]. Tirole, J., 1982. On the possibility of speculation under rational expectations. *Econometrica: Journal of the Econometric Society, 50(5),* pp. 1163-1182.
[9]. Ball, R., 2009. The global financial crisis and the efficient market hypothesis: What have we learned?. *Journal of Applied Corporate Finance, 21(4*), pp. 8-16.
[10]. Sewell, M. V., 2012. The Efficient Market Hypothesis: Empirical Evidence. *International Journal of Statistics and Probability, 1(2),* p. 164.
[11]. Hamid, K., Suleman, M. T., Shah, S. Z. A. & Akash, R. S. I., 2010. Testing the Weak form of Efficient Market Hypothesis: Empirical Evidence from Asia-Pacific Markets. *International Research Journal of Finance and Economics, Issue 58,* pp. 122-132.
[12]. Rahman, M. S., Simon, H. M. & Hossain, M. M., 2016. An Empirical Analysis of Weak Form Market Efficiency: Evidence from Chittagong Stock Exchange (CSE) of Bangladesh. *Journal of Statistics Applications & Probability, 5(3),* pp. 535-542.
[13]. Joarder, M. A. M., Ahmed, M. U., Haque, T. & Hasanuzzaman, S., 2014. An empirical testing of informational efficiency in Bangladesh capital market: Informational efficiency in Bangladesh capital market. *Economic Change and Restructuring, Volume 47,* pp. 63-87.
[14]. Shaheen, F., Rehman, A. U. & Haq, M. u., 2015. Testing the Weak Form of Efficiency of the Asian Emerging Stock Markets. *PUTAJ – Humanities and Social Sciences, 22(2*), pp. 123- 130.
[15]. Hasan, M. Z., Kamil, A. A. & Baten, A., 2011. Measuring Dhaka stock exchange market efficiency: A stochastic frontier analysis. *African Journal of Business Management, 5(22),* pp. 8891-8901.
[16]. Chaity, N. S. & Sharmin, S., 2012. Efficiency Measures of Capital Market: A Case of Dhaka Stock Exchange. *International Journal of Business and Management, 7(1),* pp. 102-108.
[17]. Rabbani, S., Kamal, N. & Salim, M., 2013. Testing the Weak-Form Efficiency of the Stock Market: Pakistan as an Emerging Economy. *Journal of Basic and Applied Scientific Research, 3(4),* pp. 136-142.
[18]. Khan, M. M. H. & Huq, U. R., 2013. An Empirical Test of Weak Form Market Efficiency on an Emerging Market: Evidence from Dhaka Stock Exchange. *Journal of Business Studies,* 34(2), pp. 187-215.
[19]. Hasan, M. A., 2015. Testing Weak-Form Market Efficiency of Dhaka Stock Exchange. *Global Disclosure of Economics and Business, 4(2),* pp. 79-90.
[20]. Hussain, S., Nath, S. K. D. & Bhuiyan, M. Y. A., 2016. Weak Form Efficiency of the Chittagong Stock Exchange: An Empirical Analysis (2006-2016). *International Journal of Business and Social Research, 6(11),* pp. 58-66.
[21]. Khandoker, M. S. H., Siddik, M. N. A. & Azam, M., 2011. Tests of Weak-form Market Efficiency of Dhaka Stock Exchange: Evidence from Bank Sector of Bangladesh. *Interdisciplinary Journal of Research in Business, 1(9*), pp. 47- 60.
[22]. Raquib, M. & Alom, K., 2015. Are the Emerging Capital Markets Weak Form Efficient? - Evidence from the Model of the Dhaka Stock Exchange. *Universal Journal of Accounting and Finance, 3(1*), pp. 1-8.
[23]. Bayezid Ali, M., 2012. Comparative Efficiency in Emerging Stock Markets: The Case of Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE). *International Journal of Academic Research in Economics and Management Sciences, 1(6),* pp. 273-254.

Appendix A: Unit root (p-p) Test results at level

Result for indices DS30 and DSEX (Daily data)

Null Hypothesis: RETURN_DS30 has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-33.22534	0.0000
Test critical values:	1% level	-3.435027	
	5% level	-2.863493	
	10% level	-2.567859	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: RETURN_DSEX has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*

Phillips-Perron test statistic		-32.74995	0.0000
Test critical values:	1% level	-3.435027	
	5% level	-2.863493	
	10% level	-2.567859	

*MacKinnon (1996) one-sided p-values.

Results for indices DS30 and DSEX (Monthly data)

Null Hypothesis: MONTHLY_DS30 has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.825309	0.0000
Test critical values:	1% level	-3.534868	
	5% level	-2.906923	
	10% level	-2.591006	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: MONTHLY_DSEX has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.239693	0.0000
Test critical values:	1% level	-3.534868	
	5% level	-2.906923	
	10% level	-2.591006	

*MacKinnon (1996) one-sided p-values.

Results for indices DS30 and DSEX (Weekly data)

Null Hypothesis: WEEKLY_DS30 has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-15.83192	0.0000
Test critical values:	1% level	-3.453567	
	5% level	-2.871656	
	10% level	-2.572233	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: WEEKLY_DSEX has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-16.35817	0.0000
Test critical values:	1% level	-3.453567	
	5% level	-2.871656	
	10% level	-2.572233	

*MacKinnon (1996) one-sided p-values

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