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Article

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Testing the Weak Form Efficiency of Karachi Stock Exchange

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Abstract

In an efficient market, share prices reflect all available information. The study of efficient market hypothesis helps to take right decisions related to investments. In this research, weak form efficiency has been tested of Karachi Stock Exchange—KSE covering the period of 2nd November 1991 to 2nd November 2011. Descriptive statistics indicated the absence of weak form efficiency while results of non-parametric tests, showed consistency as well. We employed non-parametric tests were KS Goodness-of-Fit test, run test and autocorrelation test to find out serial independency of the data. Results prove that KSE is not weak-form-efficient. This happens because KSE is an emerging market and there, it has been observed that information take time to be processed. Thus it can be said that technical analysis may be applied to gain abnormal returns.

Keywords: Weak form efficiency, KSE, Random walk theory.

1. Introduction

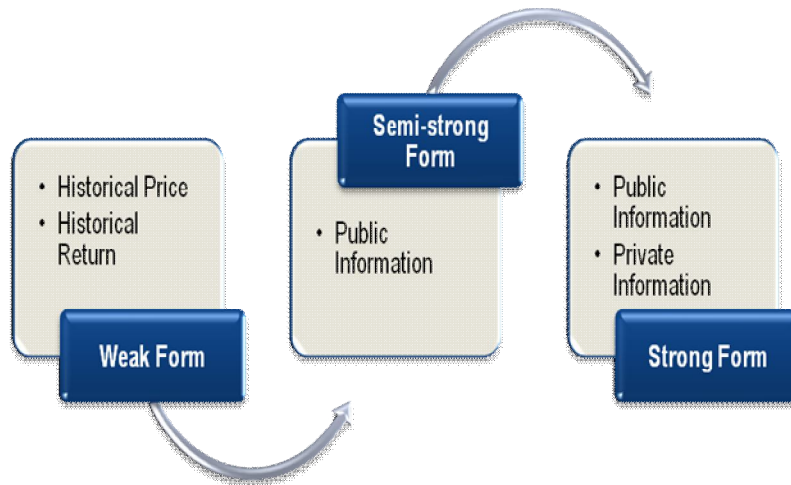
Stock markets are considered as a barometer of the economy Dholakia (2009); because stock markets facilitate investment related activities. For this reason there can be seen great interest on stock return processes and investors continuously work to find out the ways that will turn in handsome return. There is wide amount of literature on market efficiency and great debate over financial management and therefore, on market efficiency to cope up with financing and investing in stock markets. The notion of efficiency in stock market helps to understand the working mechanism of capital markets and taking right decision related to investment. Basically market efficiency is used to show the relationship between share price and information available on it.

The roots of the concept of stock market efficiency can be found in random walk hypothesis which was presented by Bachelier (1900); under the heading of “The random character of stock market prices” which proves that prices of past, today and even future have no correlation, they follow randomness. According to this theory information on share prices are processed so rapidly that it becomes impossible to have abnormal returns fully nullifying the assumptions of technical analysis. This work was extended by Fama (1965) by proposing the theory; efficient market hypothesis. The theory states that market is considered to be efficient if it quickly process its information. There exists perfect competition, following strategy of fair game. Any events or rumors do not have any long

lasting effect upon share prices. Prices adjust themselves so quickly that, no one can beat the market.

Tests of the market efficiency are essentially tests of whether the three general types of information- past prices, other public information, and inside information-can be used to make above-average returns on investments. In an efficient market, it is impossible to make above-average return regardless of the information available, unless abnormal risk is taken. Moreover, no investor or group of investors can consistently outperform other investors in such a market. Professor Fama proposed Efficient Markets Hypothesis—EMH at three levels. They are Weak Form Efficiency, Semi-strong Form Efficiency, and Strong Form Efficiency.

Figure: 1



As it can be seen from the figure 1, each successive level includes the previous one as well. EMH at weak form cannot be used to predict the future of past price. It states that price changes are random. In other words it can be said that it rejects technical analysis. This level can be tested by using run test, auto-correlation, and goodness of fitness test. At the level of semi strong level prices fully reflect the current scenario. Or it can be said that it rejects the fundamental analysis. This level can be tested by using event studies of stock splits, earning announcement, analysis recommendations, cross sectional return predictions and others. Strong form level of EMH says that prices reflect all public and private information. For test purposes earning of corporate insiders, specialists, and mutual funds can be calculated.

EMH has a lot of effect on the overall investment strategy because if the market is efficient then trying to pick overvalued securities will be a waste of time. Since market fully reflects the best estimated prices and risk and return known about them. So in an efficient market it will be more sensible to have the portfolio covering overall risk and returns. If the market is not efficient then by picking winners one can get abnormal returns.

For this reason these all levels are being tested by economist again and again to find out the behavior of stock prices i.e. Higgs (2003) worked to find out the weak form efficiency level in 16 European developed markets and four emerging markets. The

results indicated from the developed countries Germany, Ireland, Portugal, Sweden and UK stock markets were weak form efficient and from emerging markets, only Hungary stock market followed randomness in its daily returns. Raja et, al. (2009) worked to find out the semi strong level of IT industry in India their finding indicates that security prices reacted to the announcement of stock split thus not having the semi strong level of efficiency. Chau and Vayanos (2005) tested the strong form level and proved that profit of monopolistic insiders do not converge to zero.

2. Literature Review

The practice of using fundamental and technical analysis in stock markets has a long history. Proper implementations of these techniques were considered to be wise investment. This view was shaken when Fama (1965) proposed his theory of efficiency. From 1965 till today many economists and investors have tested different markets to find out the behavior of share prices. This practice does not follow only one way of testing but varies from researcher to researcher and from time to time having the same motive to test the Random Walk Hypothesis—RWH. Deviation in results may arise due to the different time horizon and data involved. These differences do not reject the employed techniques but broader our options. The theory of efficiency at weak form level deals with historical prices of shares, the main area of concern for investors. The available literature on the topic shows a mixed trend both on developed and emerging markets. Literature available on the topic can be divided into four categories, developed, cross countries, emerging and Pakistan stock markets.

In the study of developed countries it was revealed that those markets are efficient in their share prices. Hudson et, al. (1995) tested UK stock markets and concluded that technical trading rules do have predictable ability but their use is not profitable for investors due to the heavy cost involved. Gersdorff and bacon (2007) tested the efficiency in US stock markets after mergers and acquisitions. They found out that US markets are efficient at the semi strong level. Seiler and Rom (1997) examined on NYSE from February 1885 to July 1962. The results indicate that historical return follow random walk.

Studies on cross countries revealed mixed findings. Hamid et, al. (2010) worked on Asia-pacific markets. The study was done on stock market returns of Pakistan, India, Sri Lanka, China, Korea, Hong Kong, Indonesia, Malaysia, Philippine, Singapore, Thailand, Taiwan, Japan and Australia. Researchers used monthly observation for the period from January 2004 to December 2009. They concluded that in all these countries random walk theory is not applicable. Mishra (2011) tested the weak form efficiency of emerging and developed markets (India, china, Brazil, South Korea, Russia, Germany, US and UK) both over the period from January 2007 to December 2010. The application of unit root test and Garch (1,1) model estimation provides the evidence that these markets are not weak form efficient.

In case of emerging and developing countries a large number of works is available. The available data most of the time reject the weak from efficiency. Hassan et, al. (2003) worked on the Kuwait Stock Market and tested the efficiency after different regulatory reforms and found out that the market is inefficient at a weak level. Policy makers need to increase liquidity and take measures to increase efficiency. Al-Jafari (2011) tested the Bahrain stock market and found out that it is informational inefficient. Raihan and Anwar

(2007) researched on the Chittagong market and concluded that it did not follow randomness in its share prices. Debysingh and Watson (2007) tested the Jamaica and Trinidad & Tobago market to find out the efficiency after and before automation, and concluded that in both cases markets were inefficient. Oskooe, et, al. (2010) found a presence of weak form level in the Iran stock exchange. Khan, et, al. (2011) worked on Testing Weak Form Market Efficiency of the Indian Capital Market. This piece of research study's the behavior of national stock exchange and the Bombay Stock Exchange from the period of 1st April 2000 to 31st March 2010. The data was tested with the help of run test that showed Indian capital market is not weak form efficient. Ansari (2011) examined the BSE-200 share index for 10 year. Weak form efficiency was tested with the help of Autocorrelation analysis, Ljung– Box Q (LBQ) statistics and Runs test. The study clearly indicates that BSE is efficient at weak form level. Mobarek (2000) tested the Dhaka Stock Exchange for the period of 1988 to 1997 on weak form efficient level by applying both non-parametric (K–S normality test and run test) test and parametric test (Auto-correlation test, Auto-regression, ARIMA model), the study provides evidence that aforesaid the market is not weak form efficient. The study of Poshakwale (1996) gave evidence on weak form efficiency and day of the weak effects in the Indian Stock Market by using data from 1987-1994 and by applying parametric and non-parametric tests. He concluded that BSE was not weak form efficient. Al-Jarrah, et, al. (2011) proved that the Amman Stock Exchange is efficient at weak form. Mabhunu (2004) in his thesis proved that the Jakarta Stock Exchange is efficient at weak form. Awad and Daraghma (2009) concluded that the Palestinian Security Market is inefficient in its return series.

In case of Pakistani capital markets, literature indicates that Pakistani markets did not follow the random walk in share prices. Haque, et, al. (2011) tested the KSE by using weekly KSE-100 share Index over period of 2000 to 2010 and for testing the weak form efficiency, they used unit root test, serial correlation, run test and variance ratio (VR) and concluded that KSE is not weak form efficient, thus past prices can be used to predict future. Bashir, et, al. (2011) used daily closing prices of eleven high volume trading banks listed on KSE from June 2007 to April 15, 2009 and concluded that banking sector is not weak form efficient. Rashid et, al. (2009) provided evidence that equity market of Pakistan is weak form efficient but Badla and money market is not efficient at weak form for the period of July 2003 to September 2006. Akbar and Baig (2010) research topic was "Reaction of Stock Prices to Dividend Announcements and Market Efficiency in Pakistan". Their work aimed to test the semi strong form of market efficiency by looking at the reaction of stock prices by dividend announcements. Data under study was of 79 companies listed on KSE from July 2004 to June 2007. Returns were tested by using the t-test and the Wilcoxon signed rank test. The results rejected the weak form efficiency and concluded that dividend announcement has a positive effect on trading.

In the light of literature review it can be said that the use of more than one technique can prove to be helpful to find out the behavior of the market. This practice normally removes biased arising from usage of one method. As Pakistan is a developing country, here information can take several lags. This research aims to test whether stock market is efficient at weak level for the period of 2 November 1991 to 2 November 2011 or not.

3. Karachi Stock Exchange

Stock markets represent the state of economy. Stock markets provide effective means of investments for individuals and organizations. It helps to understand the working mechanism of economy and acts like an indicator. So there presence is vital for the country. Stock markets currently working in Pakistan are Karachi stock exchange, Lahore stock exchange and Islamabad stock exchange.

From all of these markets, KSE is the biggest, the oldest and most liquid stock market of Pakistan which reflects the state of national economy. The KSE established on September 18, 1947 and incorporated on March 10, 1949. At the time of incorporation, only five companies were listed with paid up capital of 37 million rupees. The first index was introduced in 1991 as KSE- 50 share index based on top 50 companies on the bases of open cry system.

At present, the picture has been completely changed. The KSE is a guarantee limited which has 200 members and there are 639 companies listed with its fold Market capitalization of US \$ 38.24 billion (June 30, 2011) having fully electronic trading system known as KATS-Karachi Automated Trading System. The system has a capacity of one million trades per day and is able to connect unlimited users. Risk is managed through Modern Risk Management System that includes VaR based margin collection, Pre-trade margin verification, and Client level margining system. Today it offers a wide range of Products includes Equities (otherwise known as the Ready Market), Deliverable Futures Contracts, Cash Settled Futures, Stock Index Futures Contracts, and Bond Trading. The KSE has four indexes, namely, KSE-100 share index, KSE All share index, KSE-30 share index and KMI-30 index. To fulfill the need of more listed companies, KSE-100 share index was introduced on 1st November 1991. The listed companies are divided into different business sectors while the index has base point value of 1000 points. Top 100 listed companies are selected on the bases of representative sector and market capitalization. These 100 companies approximately capture 90% capitalization of the companies available on the market. KSE is a major index of Pakistan that tracks the performance of companies in the Pakistan. The index recorded highest point 15676.34 on 2008 and the lowest on 1990 was 538.89. For confirmation of KSE-100 share index, the KSE All share index was introduced in 29th August 1995 that started working on 18th September of same year.

Figure: 2 - Source: www.tradingeconomics.com



Like KSE-100 share index, it is also calculated with the help of market capitalization. KSE-30 share index was introduced on 1st September 2006 with the object to gauge the performance of market over the periods. It is like other indicators that traces economy like GNP (Gross National Product), CPI (Consumer Price Index) and others. It uses free floating methodology. KMI-30 share index was introduced on September 2008, aims at to measure the performance of Shariah compliant equity investments (Islamic mode of investment). Like KSE-30 share index it also uses the method of free floating.

The above facts reveals that the KSE-100 share index handles big portion of equity trading of Pakistan and is considered most important index of KSE which reflects not only the state of national economy but also depicts the state of equity trading of Pakistan.

4. Hypothesis

H1: The Karachi Stock Market follows random walk.

H2: The Karachi Stock Market is efficient in weak form

5. Methodology

The study is based on daily closing price of KSE-100 share index from the period of 2nd November 1991 to 2nd November 2011. The data was gathered from official website of KSE, research department of Jahangir Siddiqui securities, research department of Khadim Ali Shah Securities and through different reports and periodicals published by KSE and State Bank of Pakistan. The collected data has been tested by employing different statistical techniques like, descriptive statistics, parametric and non-parametrical tests of inferential statistics. The descriptive statistics helps to identify the behavior of stock prices, its application disclose that whether the share prices have normal or non-normal distribution.

6. Results

Random walk theory or weak form efficiency states that distribution of share prices should be normal. Under normal distribution curve shows bell shape that is formed with the help of mean and standard deviation. For judging normality two concepts are applied skewness and kurtosis Zar (1996). Descriptive statistics describes and summarizes the whole data. Univariate analysis mainly focuses upon distribution (frequency of individuals or range of variables), mean and dispersion (measures range and standard deviation).

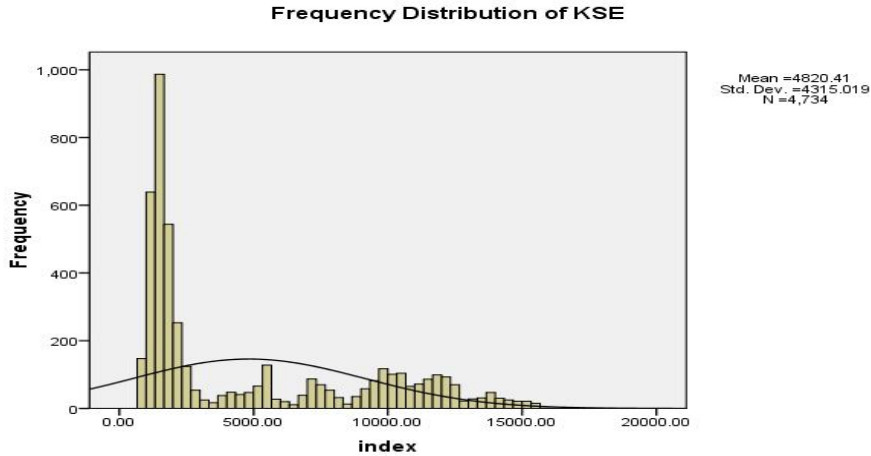
Skewness deals with symmetric structure. It can be positive or negative or undefined. Negative skewness shows that tail on left side is longer than right side and positive skewness shows that on right side is longer than left side. Its zero value indicates that values are normally distributed (Weiss, 1999). The other concept is kurtosis (bulging). It deals with the peakedness. Under symmetrical distribution quite peaked or tall histogram is known as leptokurtic, comparatively flat as platykurtic, moderate as mesokurtic. If both skewness and kurtosis has zero answer that means distribution is normal (Levin, et, al. 1994).

As discussed earlier that random walk theory is based on the assumptions that if the stock prices are random then its distribution should be normal. Any normal distribution gives an advantage because only two summary measures, mean and variance are normally used

to describe the entire distribution. In order to fit the normal distribution, histograms of the index have been computed and curve for normal distributions have been fitted in order to ascertain whether the distribution of index values fits the normal distribution or not.

As histogram given figure 3 indicates that distribution is positively skewed showing non-normal behavior of share prices and from calculation it is obvious that kurtosis is non-zero. So it can be said that distribution of KSE is not normal. While the results of descriptive statistics, given table 1 clearly indicate that KSE is not weak form efficient.

Figure: 3



Non parametric (distribution free methods) is opposite to parametric tests. Parametric tests are usually used when distribution is normal. From descriptive statistics it is clear that distribution of share prices on KSE is not normal. Further evidences were obtained by conducting non-parametric tests. They include Kolgomorov smirnov goodness of fit test, Run test and Autocorrelation test

Table 1: Descriptive Statistics

S.E. Skew	0.04	Range	14,910.61
Minimum	765.73	Maximum	15,676.34
Mean	4,820.41	Kurtosis	(0.78)
Variance	18,619,391.37	Standard Deviation	4,315.02
S.E. Kurtosis	0.07	Skewness	0.86

Kolgomorov Smirnov Goodness of Fit test is a non parametric test named after two Russian Mathematicians Andrei Nikolaevich Kolgomorov and Nikolai Vasil'evich Smirnov who worked on its development. It is a one sample test use to find out normality and uniformness of the data. It is used to compare sample's cumulative distribution with standard cumulative distribution Zar (1996). The Table 2 shows the results of KS tests on 5% significance level that clearly indicate that KSE is not weak form efficient.

Table 2: One sample Kolgomorov Smirnov Goodness of Fit Test

	Absolute	Positive	Negative	K-S Z	Z-Tailed P
Normal	0.26527	0.26527	-0.17528	18.2517	0
Uniform	0.44496	0.44496	-0.00212	30.6147	0

Run test is also a non-parametric test that is used to find out serial independence, was presented by Abraham Walt and Jacob wolfowitz and is also known as walt-wolfowitz tests. The run test defines a sequence of changes having same sign. Like a serial has positive sign for a particular time than replaced by another. In this way it goes on. There are three types of runs which compare the expected number of runs with the resulted number of runs. With the help of the run test one comes to know whether the share prices have random behavior or not. In the absence of normality a run may have increasing or decreasing values. To find out normality under run test we need to use the mean and variance. The results of the runs test are below in the Table 3. The runs test converts the total number of runs into a Z statistic. It indicated that the total numbers of runs are only 12 having a zero observed significance level which rejected the hypothesis that the series is random.

Table 3: Runs Test

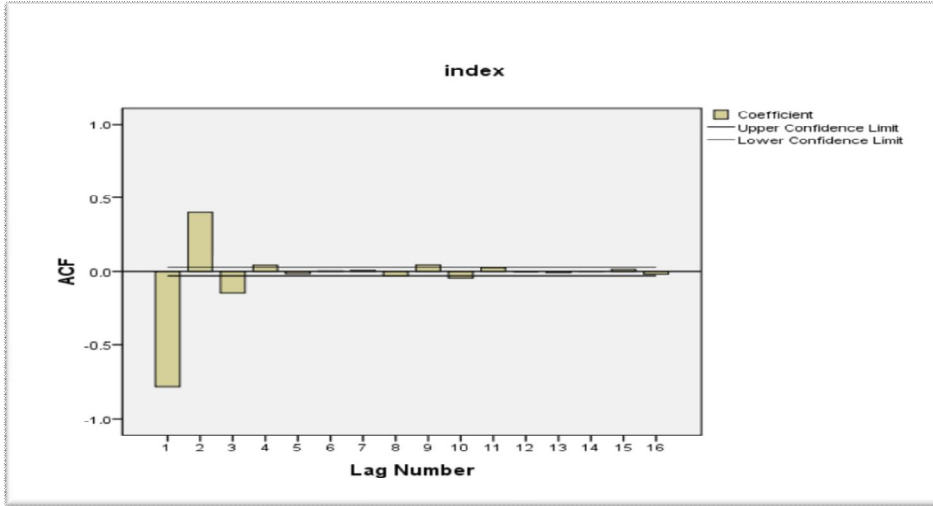
	Index
Test Valuea	2059.96
Cases < Test Value	2367
Cases >= Test Value	2367
Total Cases	4734
Number of Runs	12
Z	-68.492
Asymp. Sig. (2-tailed)	.000
a. Median	

Auto correlation is a process that is used to find out correlation between past and future values. This is also known as lagged correlation or serial correlation to predict the future. In it we use three tools, which are: time series plot, lagged scatter plot and autocorrelation. In it stock prices are arranged over a period of time. If values show a positive correlation it means share prices have a persistence behavior. If no correlation is found than it is concluded that the values are random. The Figure 4 shown below having several lags clearly indicates that the KSE is not weak form efficient. Because the available information is at several lags while it is evident that there is significant negative autocorrelation on the first lag. Further, the autocorrelations on the 9th and 10th lags may

be ascribed to the two week settlement period (a week comprise of five working days), followed at the KSE.

Another evidence of presence autocorrelation coefficients in the transformed series on the 1st, 3rd, 5th, 8th 10th and the 14th lags conclude that there is serial dependence between the values. Therefore, the null hypothesis that there are no first orders autocorrelations present in the series is rejected.

Figure: 4



7. Conclusions

This piece of research is an added work on the working of testing the efficiency of KSE. It analyzes the behavior over period of 2nd November 1991 to 2nd November 2011. For testing the efficiency at weak form level of efficient market hypothesis different tests were applied. The aim to apply different tests was to add the reliability of work. Descriptive statistics show that frequency distribution is non-normal and positively skewed. For testing random walk hypothesis non parametric tests were Kolgomorov smirnov goodness of fit test, run test, and autocorrelation test. All these tests significantly rejected the null hypothesis and revealed that KSE is not weak form efficient, thus it does not have random walk behavior in its share prices. Thus it can be concluded that the past prices and returns can help to take investment related decisions or in other words the technical analysis is applicable to KSE.

REFERENCES

Akbar, M and Baig, H.H. (2010). Reaction of Stock Prices to Dividend Announcements and Market Efficiency in Pakistan. *Lahore Journal of Economics*, 15 (1), 103-125.

Al-Jafari, M.K. (2011). Testing the Weak-Form Efficiency of Bahrain Securities Market. *International Research Journal of Finance and Economics*, Issue 72, 14-24.

- Al-Jarrah, M.I., Khamees, B.A. and Qteishat, I.H. (2011). The "Turn of the Month Anomaly" in Amman Stock Exchange: Evidence and Implications. *Journal of Money, Investment and Banking*, Issue 21, 5-11.
- Ansari, (2011). Testing Weak Form Stock Market Efficiency on Bombay Stock Exchange of India Tenth International Conference on Operations and Quantitative Management.
- Awad, I. and Daraghma, Z. (2009). Testing the Weak-Form Efficiency of the Palestinian Securities Market. *International Research Journal of Finance and Economics*, Issue 32, 7-17.
- Bashir, T., Ilyas, M. and Furrugh, A. (2011). Testing the Weak-Form Efficiency of Pakistani Stock Markets-An Empirical Study in Banking Sector. *European Journal of Economics, Finance and Administrative Sciences*, Issue 31, 160-175.
- Davis, Mark and Etheridge, Alison, (2006). *Louis Bachelier's Theory of Speculation: The Origins of Modern Finance*, New Jersey: Princeton University Press,
- Dholakia. (2009). Stock Market: The Barometer of Economy's Health. Stock markets, BlogSpot
- Fama E. (1965). The Behavior of Stock-Market Prices. *The Journal of Business*, 38(1), 34-105.
- Gersdorff, N. von, and Bacon, F. (2009). U.S. Mergers and acquisitions: a test of market efficiency. *Journal of Finance and Accountancy*, 1(8), 1-8.
- Hamid, K., Suleman, M.T., Shah, S.Z.A. and 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, 121-133.
- Haque, A. Liu, H-C and Fakhar-Un-Nisaet. (2011). Testing the Weak Form Efficiency of Pakistani Stock Market-2000 to 2010. *International Journal of Economics and Finance*, 1(4), 153-162.
- Hassan, K.M. Al-Sultan, W.S. and Al-Saleem, J.A. (2003). Stock Market Efficiency in the Gulf Cooperation Council Countries (GCC): The Case of Kuwait Stock Exchange. *Scientific Journal of Administrative Development*, 1(1). 1-21.
- Worthington, A.C. and Higgs, H. (2003). Weak-form Market Efficiency in European Emerging and Developed Stock Markets. School of Economics and Finance Discussion Papers and Working Papers Series 159, School of Economics and Finance, Queensland University of Technology, Brisbane, Australia.
- Hudson, R., Dempsey, M. and Keasey, K. (1996). A Note on the Weak Form Efficiency of Capital Markets: An Application of Simple Technical Trading Rules to UK Stock Prices– 1935 to 1994. *Journal of banking and finance*, 20(6), 1121-1132.
- Khan, A.Q., Sana, I. and Mehtab, M. (2011). Testing Weak Form Market Efficiency of Indian Capital Market : A case of National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). *African Journal of Marketing Management*, 3(6), 115-127.
- Levin J, and Fox A.J. (1994), "Elementary Statistics in Social Research (6th edition). New York: Harper Collins College Publishers.

- Mabhunu, M. (2004). The Market Efficiency Hypothesis and the Behavior of Stock Returns on the JSE Securities Exchange. Master Thesis, Rhodes University, South Africa.
- Mishra, (2011). Weak Form Market Efficiency: Evidence from Emerging and Developed World. *The Journal of Commerce*, 3(2). 2220-6043.
- Mobarek, (2000). Weak-form Market Efficiency of an Emerging Market: Evidence from Dhaka Stock Market of Bangladesh. ENBS Conference held on Oslo
- Oskooe, S.A.P., Li, H. and Shamsavari, A. (2010). The Random Walk Hypothesis in Emerging Stock Market. *International Research Journal of Finance and Economics*, Issue 50, 51-61.
- Poshakwale, (1996). Evidence on Weak Form Efficiency and Day of the Week Effect in the Indian Stock Market. *Finance India*, 10(3), 605-616.
- Raihan, and Anwar U. (2007). Chittagong Stock Market of Bangladesh: Turning of a Weak-Form Market into an Efficient Market. *SAAC Journal of Human Resource Development*, 3, 26-45
- Raja, M. Sudhahar, J.C. and Selvam, M. (2009). Testing the Semi-Strong form Efficiency of Indian Stock Market with Respect to Information Content of Stock Split Announcement – A Study in IT Industry. *International Research Journal of Finance and Economics*, Issue 25. 7-20.
- Rashid, A. and Fazal, H. (2009). Testing the Weak Form Efficiency in Pakistan's Equity, Badla and Money Markets. MPRA Paper 22285, University Library of Munich, Germany.
- Seiler, M.J. and Rom, W. (1997). Historical Analysis of Market Efficiency: Do Historical Returns Follow a Random WALK?. *Journal of Financial and Strategic Decisions*, 10 (2), 49-57.
- Chau, M. and Vayanos, D. (2005). Strong-form efficiency with monopolistic insiders. CEPR, London School of Economics and Political Science, London, UK. [Online] Available: <http://eprints.lse.ac.uk/458/>
- Debysingh, N. and Watson, P.K. (2007). Automation & Efficiency in Two Emerging Equity Markets. CCMS 39th Annual Monetary Studies Conference
- Weiss, A.N. (1999). *Introductory Statistics (5th edition)*. Boston: Addison-Wesley Publishing Company.
- Zar, H.J. (1996). *Bio Statistical Analysis (3rd edition)*. New Jersey: Prentice Hall Inc.