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Dr. Neelam Gupta
Associate Professor of Commerce, C.M.K. National PG Girls College, Sirsa, Haryana, India

Corresponding Author:
Dr. Neelam Gupta
Associate Professor of Commerce, C.M.K. National PG Girls College, Sirsa, Haryana, India

A study of individual stock through box-Ljung Q-statistic based on autocorrelation matrices

Dr. Neelam Gupta

Abstract
Weak form of market efficiency to find out stock price movements in less developed capital markets. The study related to 1973-1978 period and for 23 stocks listed on the Bombay Stock Exchange. With the help of moving average, it has been found that random walk model appears to be an adequate representation of the price behaviour of individual stocks trade on the BSE. He further confirmed that the parameters estimated through the sample stocks were insignificantly different from zero resulted into a generalization of random behaviour of successive movement of stock prices over the BSE.

Keywords: Stock, box-Ljung, the efficient markets hypothesis (EMH), return, India

1. Introduction
The efficient markets hypothesis predicts that market prices should incorporate all available information at any point in time. There are, however, different *kinds* of information that influence security values. Consequently, financial researchers distinguish among three versions of the Efficient Markets Hypothesis (EMH), depending on what is meant by the term "all available information".

1.1 Weak Form Efficiency
The weak form of the efficient markets hypothesis asserts that the current price fully incorporates information contained in the past history of prices only i.e. nobody can detect mis-priced securities and "beat" the market by analyzing past prices. The weak form of the hypothesis got its name for a reason - security prices are arguably the most public as well as the most easily available pieces of information. Thus, one should not be able to profit from using something that "everybody else knows". On the other hand, many financial analysts attempt to generate profits by studying exactly what this hypothesis asserts is of no value - past stock price series and trading volume data. This technique is called technical analysis. The empirical evidence for this forms of market efficiency, and therefore against the value of technical analysis, is pretty strong and quite consistent. After taking into account transaction costs of analyzing and of trading securities, it is very difficult to make money on publicly available information such as the past sequence of stock prices. The weak-form of EMH assumes that current stock prices fully reflect all historical information, including past returns. Thus investors would gain little from technical analysis, or the practice of studying a stock's price chart in an attempt to determine where the stock price is about to go in the future. Excess returns cannot be earned by using investment strategies based on historical share prices. Weak-form efficiency implies that technical analysis techniques will not be able to consistently produce excess returns, though some forms of fundamental analysis may still provide excess returns.
In a weak-form efficient market current share prices are the worst, biased, estimate of the value of the security. Theoretical in nature, weak form efficiency advocates that fundamental analysis can be used to identify stocks that are undervalued and overvalued. Therefore, keen investors looking for profitable companies can earn profits by researching financial statements.

1.2 A Weak-form Efficiency Test Example

Technical analysts employ a vast range of trading rules. Some recommend buying shares that have performed well relative to the rest of the market, maintaining that their performance will continue in that vein. Others advise a purchase when a share rises in price at the same time as an increase in trading volume occurs. The history of share prices cannot be used to predict the future in any abnormally profitable way. The argument runs as follows. 'New' information must by definition be unrelated to previous information; otherwise it would not be new. It follows from this that every movement in the share price in response to new information cannot be predicted from the last movement or price, and the development of the price assumes the characteristics of the random walk. In other words, the future price cannot be predicted from a study of historic prices.

If a market is weak-form efficient, there is no correlation between successive prices, so that excess returns cannot consistently be achieved through the study of past price movements. Bansal Monica (2010) [12] stated that this kind of study is called technical or chart analysis, because it is based on the study of past price patterns without regard to any further background information.

Several studies address the issue of whether stock price behavior is a random walk or not. Robert (1959) and Osborne (1959) found that stock price movement follows a random walk. "The random walk hypothesis simply states that at a given point of time, the size and direction of the next price change is random with respect to the knowledge available at that point in time". The argument that stock price change is random does not mean that stock price changes without any reasons; there is a reason for such movement, which has been the subject of empirical research for over a decade. Bansal, Monica (2019) [15] stated that here have been four major methods to test the dependence of return on time (Weak Form of Market Efficiency); serial correlation test, filter rule test, cyclical test and volatility test.

2. Review of Literature

Al-Loughani and Chappell (1997) examined the validity of the weak-form efficient market hypothesis for the United Kingdom stock market using the Lagrange multiplier (LM) serial correlation, Dickey-Fuller unit root and Brock, Dechert and Scheinkman (BDS) non-linear tests. The data included daily observations of Financial Times Stock Exchange (FTSE) 30-share index from the period June 30, 1983 to November 16, 1989, a period that they described as free of changing government economic policy toward financial markets. The result of Dickey Fuller tests showed that series were non-stationary in levels and is stationary in first differences, which are consistent with random walk hypothesis. However, based on the BDS and serial correlation tests, they rejected the random walk hypothesis finding auto correlation and conditional heteroskedasticity in the FTSE 30 returns. Therefore, according to their results, the series of FTSE 30-share index does not follow a random walk during the sample period.

Groenewold (1997) examined both weak and semi-strong forms of the EMH for Australia and New Zealand using daily observations on the Statex Actuaries' Price Index for Australia and the NZSE-40 Index for New Zealand covering the 1975-1992 sample period. Weak form efficiency tested using the Dickey Fuller and Phillips-Peron unit root tests, variance ratio and auto correlation tests, and semi-strong efficiency tested using both co-integration and Granger causality tests. The results of unit root tests showed that both indexes were consistent with the non-stationary implications of the weak form of the EMH, whereas the autocorrelations provide evidence of return predictability. However, he found that degree of predictability of returns were not high, that 24 lagged returns being only little over 5 per cent. Moreover, the result of variance ratio did not reject the random walk hypothesis in both markets. Therefore, he argued that taken as evidence against the weak form of the EMH is not altogether clear. The two countries' indexes were found not to be co-integrated, which was consistent with market efficiency, but however, the Granger causality were unable to reject, which is evidence against the EMH. With regard to all results, Groenewold concluded that past returns in both countries might help to explain the current return in each, but the proportion of variation explained was still small.

Ramsey and Zhang (1997) tied their results of 'localized frequency bursts' to news events to provide useful insights into market behaviour. In this regard, the EMH asserted that if market was efficient, then new information will be reflected quickly and unbiased into market prices. Conversely, in an inefficient market, there will either be over-reaction or delayed response, where it took some time before reaching the equilibrium price. Statistical findings of random walk movements in historical price series provided evidence of weak-form market efficiency, indicating that new information was quickly impounded in current market prices. In contrast, evidence of linear/non-linear dependency structures reflects those periods in which the speed of adjustment to new information was not immediate, due to certain underlying factors.

Dimson and Massabian (1998) studied that the efficient market hypothesis was simple in principle but remains elusive. It is hard to profit from even the most extreme violations of market efficiency. The efficient markets model continuous to provide a framework that is widely used by financial economists.

Conrad and Juttner (1999) worked on weak form of market efficiency with the help of daily closing prices of 54 stocks. The stock which had the highest number of quotations has been chosen from January 2, 1968 to April 22, 1971. Each stock thus adjusted for stock splits to avoid distortion of the results through runs analysis and serial correlation. In the study, it has been discovered that the expected number of runs (549.5) far exceeded the actual number of runs, which vary in the range 130-417. The results which were obtained demonstrated significantly no random behaviour of the price changes and therefore, the cyclic movements of the stock prices. The most striking nature of the results of the serial correlation values were the lowest absolute value for r_1=0.0017, the highest r_1=0.5021. Some coefficients were so close to zero that one could arrive at the conclusion, in contradiction to the previous tests, that successive changes in stock prices were independent.

Arumugam (1999) studied the behaviour of stock prices during various days of the week effects, i.e., Monday, Tuesday, Wednesday, Thursday and Friday weak form the market efficiency in stock returns pertained to the daily closing stocks prices comprising BSE-sensex for 18 years period from April 4, 1979 to march 31, 1997. The study

revealed that the bull phase witnessed significant negative returns and the bear phase witnessed significant positive returns for Monday. It also noted significant positive Friday returns at 1 percent level of the entire study period.

Brooks *et al.* (2000) attributed the findings of non-linear dependencies to two important events occurred during their sample period- widespread upsets in the currency markets and a change in U.S. accounting procedures that affected U.S. firms with business abroad. He explained that when surprises hit the market, they generally generate a pattern of non-linear price movements relative to previous movements since the traders were unsure of how to react and hence they responded slowly.

3. Objective of the Study

The main objective of this research paper is to study Box-Ljung Q-Statistic based on Autocorrelation Matrices from 1996 to 2011.

4. Analysis and Interpretation

This section examined the weak form efficient markets hypothesis of the Ghana Stock Market using a new robust non-parametric variance-ratios test in addition to its parametric alternative and concluded that stock returns were conclusively not efficient in the weak form, neither from the perspective of the strict random walk nor in the relaxed martingale difference sequence sense. Unlike previous evidence, the finding was robust to thin-trading, sub-sample periods as well as the choice of dataset. Consistent with prior studies, the results of the parametric variance-ratios test were ambiguous. By contrast, its non-parametric alternative provided conclusive results.

Table 1: Box-Ljung Q-Statistic based on Autocorrelation Matrices (1996-2011)

Code	Name of Company Stock	Q-Statistics	Code	Name of Company Stock	Q-Statistics
1	A B B Ltd.	28.898**	35	Hindustan Petroleum Corpn. Ltd.	31.262
2	A C C Ltd.	41.333*	36	Hindustan Unilever Ltd.	48.613*
3	Aban Offshore Ltd.	154.646*	37	Housing Development Financ. Corpn. Ltd.	48.146*
4	Adani Enterprises Ltd.	55.524*	38	I D B I Bank Ltd.	32.86*
5	Aditya Birla Nuvo Ltd.	89.352*	39	I F C I Ltd.	18.983
6	Ambuja Cements Ltd.	28.169**	40	I T C Ltd.	40.987*
7	Apollo Hospitals Enterprise Ltd.	73.087*	41	Indian Hotels Co. Ltd.	13.918
8	Apollo Tyres Ltd.	52.205*	42	Infosys Ltd.	44.185*
9	Areva T & D India Ltd.	389.374*	43	J S W Ispat Ltd.	23.364
10	Ashok Leyland Ltd.	28.757**	44	J S W Steel Ltd.	14.960
11	Asian Paints Ltd.	48.191*	45	Jindal Saw Ltd.	39.797*
12	Aurobindo Pharma Ltd.	56.047*	46	Kotak Mahindra Bank Ltd.	21.067
13	Bajaj Holdings & Invst. Ltd.	37.472*	47	L I C Housing Finance Ltd.	13.509
14	Bharat Forge Ltd.	32.787*	48	Mahindra & Mahindra Ltd.	23.005
15	Bharat Heavy Electricals Ltd.	25.070	49	Oil & Natural Gas Corpn. Ltd.	16.038
16	Bharat Petroleum Corpn. Ltd.	26.348**	50	Oriental Bank Of Commerce	8.382
17	Bosch Ltd.	100.688*	51	Piramal Healthcare Ltd.	19.878
18	Castrol India Ltd.	308.853*	52	Ranbaxy Laboratories Ltd.	16.402
19	Century Textiles & Inds. Ltd.	31.990**	53	Reliance Capital Ltd.	41.002*
20	Chambal Fertilisers & Chemicals Ltd.	26.902**	54	Reliance Industries Ltd.	19.548
21	Cipla Ltd.	42.956*	55	Reliance Infrastructure Ltd.	32.316*
22	Colgate-Palmolive (India) Ltd.	14.615	56	Siemens Ltd.	6.454
23	Crompton Greaves Ltd.	26.231	57	State Bank Of India	12.953
24	Cummins India Ltd.	10.186	58	Steel Authority Of India Ltd.	0.748
25	Dabur India Ltd.	26.552**	59	Sun Pharmaceutical Inds. Ltd.	39.481*
26	Dr. Reddy'S Laboratories Ltd.	12.724	60	Tata Chemicals Ltd.	29.384**
27	Exide Industries Ltd.	8.590	61	Tata Global Beverages Ltd.	10.425
28	Federal Bank Ltd.	13.991	62	Tata Motors Ltd.	41.108*
29	Glaxosmithkline Consumer Healthcare Ltd.	20.691	63	Tata Power Co. Ltd.	20.454
30	Glaxosmithkline Pharmaceuticals Ltd.	17.770	64	Tata Steel Ltd.	46.718*
31	Grasim Industries Ltd.	43.765*	65	Thermax Ltd.	37.661*
32	H D F C Bank Ltd.	513.684*	66	Titan Industries Ltd.	10.267
33	Hero Honda Motors Ltd.	22.617	67	Voltas Ltd.	35.523*
34	Hindalco Industries Ltd.	6.688	68	Zee Entertainment Enterprises Ltd.	52.134*

Source: Data Complied from CMIE – Prowess database.

** Significant at 5 per cent level of significance. * Significant at 10 per cent level of significance.

5. Conclusion

It aimed to find evidence supporting the presence of the weak form efficiency of several emerging African stock markets by using both parametric as well as non parametric tests. The results indicated that none of the markets were characterised by random walks with the exception of the South African stock market. On the other hand, this study aimed to detect the presence of the day of the week effects of these African stock markets. Results showed the existence of day of the week effects, that was the typical negative Monday and positive Friday effects in several stock markets.

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