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ANALYSING RANDOMNESS OF SECURITY PRICES: A STUDY ON PHARMACEUTICAL SECTORS IN INDIAN STOCK MARKETS

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Abstract

In the pace of economic and industrial development along with the process of globalization and liberalization empowered the private sectors to penetrate into capital markets, which was predominated by public sectors? These two sectors inextricably mixed up to influence the stock markets as the fund mobilization centers for the shake of industries and trade. In recent past, due to the rapid increase of financial demand by the varieties of business enterprises generated a new economic era in which the capital market plays a key role for flow of funds. Concomitant with this, there has been a rise in the capital markets underscoring the importance of flow of funds in which the demand for the capital funds developed by business ventures could be met by supply of funds is set in capital markets and the efficiency of the process is essential for ensuring that these capital resources are used optimally. If there is any inefficient performance of the capital market, asset market will become considerably speculative in addition to sub-optimal allocation of resources. In an efficient market, all the information is reflected in security price. Efficient stock prices and yields provide benchmarks against which the cost of capital for and return on investments projects can be judged, even if such projects are not financed through stock market. Under this light, the present study has been carried out on pharmaceutical stocks to highlight whether the market is efficient enough in pricing the securities. A run test is used to test the independent ness of successive price changes at an aggregate level as well as at individual stock level. Again, the random walk hypothesis is studied for security prices in pharmaceutical sector.

Key Words: - Capital market, asset market, stock prices, return on investment, serial correlation, run test.

1. INTRODUCTION

A financial market can be defined as the market in which financial assets are created or transferred. As against a real transaction that involves exchange of money for real goods or services, a financial transaction involves creation or transfer of a financial asset. Financial assets

or instruments represent a claim to the payment of a sum of money sometimes in future and for periodic payment in the form of interest or dividend. A financial market includes money market, capital market, forex market and debt market. Out of these the capital market is designed to finance the long term investments. The transaction taking place in this market will be for periods more than one year.

The capital market works in a given economic and industrial scenario. Indian economy over the three decades after independence was dominated by the public sector companies, which was considered as the major vehicle for economic and industrial development. The trend however changed with the liberalization and greater freedom given to private sector. This lead to the emergence of the stock markets as funds mobilizing centers for industry and trade. So a proper channel originated within the financial system to ensure the transfer of fund between the lender and borrower, termed as financial intermediaries. Financial intermediation in the organized sector is conducted by a wide range of institutions functioning under the overall surveillance of the Reserve Bank of India. In the early stages, the role of intermediary was mostly related to ensure transfer of funds from the lender to the borrower. This service was offered by banks, FIs, brokers and dealers. However as the financial system widened along with the developments taking place in the financial markets, the scope of its operation has been enlarged. Some of the important intermediaries operating in the financial markets include investment bankers, underwriters, stock exchanges, depositaries, custodians, portfolio managers etc. Though the market is different there may be few intermediaries offering their services in more than one market e.g. underwriters. However the services offered by them vary from one market to another.

The primary market is a place where corporate raise capital by way of public issue, rights issue or by private placement of their securities and in the secondary market these securities are traded after they are being initially offered in the primary market. Most trading is done in the secondary market. As against the primary market secondary market provides liquidity to the capital market. The secondary market has an important role to play behind the developments of an efficient capital market. Secondary market connects investors' favoritism for liquidity with the capital users' wish of using their capital for a longer period. Therefore the price of fund is set in the capital market and the efficiency of their process is essential for ensuring that these capital resources are used optimally. If there is any inefficient performance of capital market, the assets will become considerably speculative in addition to suboptimal allocation of resources. In an efficient market all the information are freely available and it is reflected in the security prices. Efficient stock price and yields provide benchmarks against which the cost of capital for and returns on investments can be judged, even if such projects are not financed through stock markets. So the stock prices provide a base to study the efficiency of a capital market.

2. EFFICIENT MARKET HYPOTHESIS

The most controversial issue in finance is possibly whether the financial market is efficient in allocating or using economic resources and information or not. In this context "an efficient capital market is a market that is efficient in processing information… in other words, in efficient market prices fully reflects available information

The efficient-market hypothesis was first expressed by Louis Bachelier, a French mathematician, in his 1900 dissertation, "The Theory of Speculation". His work was largely

ignored until the 1950s; however beginning in the 30s scattered, independent work corroborated his thesis. A small number of studies indicated that US stock prices and related financial series followed a random walk model. Research by Alfred Cowles in the '30s and '40s suggested that professional investors were in general unable to outperform the market.

The efficient-market hypothesis emerged as a prominent theory in the mid-1960s. Paul Samuelson had begun to circulate Bachelier's work among economists. In 1964 Bachelier's dissertation along with the empirical studies mentioned above were published in an anthology edited by Paul Cootner. In 1965 Eugene Fama published his dissertation arguing for the random walk hypothesis, and Samuelson published a proof for a version of the efficient-market hypothesis. In 1970 Fama published a review of both the theory and the evidence for the hypothesis. The paper extended and refined the theory, included the definitions for three forms of financial market efficiency: weak, semi-strong and strong. In weak form efficiency, the information set is that the market index reflects only the history of prices or returns themselves. In semi strong form efficiency the information set includes the most information known to all market participants. In strong form efficiency, the information set includes all information known to any market participant.

3. OBJECTIVES OF STUDY:

The present study has been carried out on pharmaceutical stocks to highlight whether the market is efficient enough in pricing the securities or not. So the basic objectives of this study are as follows:

1. To test whether successive price changes at an aggregate level as well as at individual stock level are independent or not.
2. To find out whether the security prices follow random walk or not.
3. To find out whether the pharmaceutical industry is efficient in pricing securities or not.

4. SOURCES OF DATA:

The present study employs daily closing prices of 16 Pharmaceutical companies listed in the National Stock Exchange (NSE) of India from January 2007 to December 2008 at Bhubaneswar Stock Exchange.

5. RESEARCH METHODOLOGY:

In order to achieve the above objectives we use serial correlation technique up to order 10. The serial correlation coefficient of order 'k' is given by:

$$r_k = \frac{Cov(Y_t, Y_{t+k})}{SD(Y_t) \times SD(Y_{t+k})}$$

$$= \frac{n\sum Y_t Y_{t+k} - \left(\sum Y_t\right)\left(\sum Y_{t+k}\right)}{\sqrt{\left[n\sum Y_t^2 - \left(\sum Y_t\right)^2\right]\left[n\sum Y_{t+k}^2 - \left(\sum Y_{t+k}\right)^2\right]}}$$

for k = 1, 2, 3, ..., 10.

Where Y_t and Y_{t+k} are the prices of a particular stock at time t and t+k respectively.

This technique is used to study the independent-ness of the successive price changes as observed from stock prices.

Again Run test is used to study the randomness of security prices over time and also the efficiency of capital market. A run is basically a sequence of one symbol such as + or -. Run test of randomness assumes that the mean and variance are constant and the probability is independent.

The expected number of runs of all types can be computed as follows:

$$M = \frac{N(N+1) - \sum_{i=1}^{m} n_i^2}{N}$$

Where, M= Expected number of runs,
N= Total number of price changes,
n_i = Number of price changes of each sign.

The standard error of expected number of runs of all signs may be obtained as follows

$$\delta = \left[\frac{\sum_{i=1}^{m} n_i^2 \left[\sum_{i=1}^{m} n_i^2 + N(N+1) \right] - 2N \sum_{i=1}^{m} n^3 - N^3}{N^2 (N-1)} \right]^{\frac{1}{2}}$$

For testing the significance of the difference between observed and expected number of runs, Z statistics is used and it is defined as:

$$Z = \frac{R + \frac{1}{2} - M}{\delta_m}$$

Where, R = Actual number of runs
M = Expected number of runs
δm = Standard error

Assumptions in run test of randomness:

1. **Data level:** In run test of randomness, it is assumed that the data is recorded in order and not in a group. If data is not in order, then we have to assign the mean, median or mode value to the data.

2. **Data Scale:** In run test of randomness it is assumed that data is in numeric form. This condition is compulsory in run test of randomness, because in numeric data, it is easy to assign run to the numeric data.
3. **Distribution:** Run test of randomness is a nonparametric test, so it does not assume any assumption about the distribution.
4. In run test of randomness, the probability of run is independent.

6. ANALYSIS AND INTERPRETATION:

Table-1

Serial correlation of Various Orders

Name of the Company	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
DR.REDDY	0.092	0.121	0.131	0.124	0.110	0.131	0.126	0.139	0.124	0.113
LUPIN	0.100	0.110								
GLENMARK	0.087	0.091								
DABUR(INDIA)	0.091	0.110								
BICON	0.088	0.128								
DIVIS LAB	0.074	0.131								
CILPA	0.099	0.098								
RANBAXY	0.071	0.087								
CADILA	0.069	0.072								
AVENTIS	0.101	0.126								
SUN PHARMA	0.090	0.089								
ORICHID	0.098	0.110								
STRIDES	0.099	0.129								
WOCKARDT	0.100	0.137								
GLAXO	0.078	0.098								
AUROBINDA	0.097	0.121								

From the above table of serial correlation of orders 1 to 10 indicates that the values their correlation coefficients lies between -0.15 to +0.15, which provides a strong evidence towards the interdependence of successive stock prices recorded on different days for all the companies.

Table-2

Sl no,	Name of the Company	NO "+"	NO "-"	Expected number of Runs (M)	Actual number of Runs (R)	Standard error of expected number of Runs (δm)	Standardized normal variate (Z)	K=R-M/M	Standard error (δm)
1	DR.REDDY	240	254	247.802	251	11.093	0.333	0.013	11.092
2	LUPIN	232	262	247.089	229	11.061	(1.590)	(0.073)	11.060
3	GLENMARK	203	190	338.504	200	8.988	(15.354)	(0.409)	8.987
4	DABUR(INDIA)	198	224	214.198	221	10.195	0.716	0.032	10.195
5	BICON	232	260	246.203	229	11.043	(1.513)	(0.069)	11.043
6	DIVIS LAB	249	247	245.992	239	11.147	(0.582)	(0.028)	11.146
7	CILPA	235	255	251.579	240	10.993	(1.007)	(0.046)	10.993
8	RANBAXY	253	237	245.739	273	11.045	2.513	0.110	11.044
9	CADILA	223	270	245.260	241	10.989	(0.342)	(0.017)	10.989
10	AVENTIS	229	264	246.258	241	11.035	(0.431)	(0.021)	11.034
11	SUN PHARMA	224	269	245.446	252	10.998	0.641	0.026	10.997
12	ORICHID	225	265	245.870	232	10.972	(1.218)	(0.056)	10.971
13	STRIDES	206	288	241.194	231	10.795	(0.898)	(0.042)	10.795
14	WOCKARDT	214	278	245.850	239	10.870	(0.584)	(0.027)	10.869
15	GLAXO	0	0	495	1	0	0	(0.997)	0
16	AUROBINDA	230	260	251.073	237	10.970	(1.237)	(0.056)	10.970

The total number of observed and expected runs of all companies along with standard errors of expected runs and values of standard normal variate Z are shown above. By analyzing the above table it is found that, the observed number of runs fall short of the expected number of

runs in case of 13 no. of companies, where as in case of 04 companies the observed number of runs is more than the expected number of runs. As the expected number of runs conform to the randomness criteria, anything falling short means non-randomness or in other words there may be some clustering. If we look at the magnitude of difference between actual and observed number of runs, we would find that in 14 no. of cases it is significant at 5% level. In other words it is less than the value of Z at 5% level i.e. 1.96. But only in Ranbaxy the value of Z is more than 1.96. This result tells us that only in case of Ranbaxy, there exists some clustering and in all other cases it is showing non randomness.

7. CONCLUSION:

The present study analyses the stock prices observed by 17 listed pharmaceutical companies from Bhubaneswar Stock Exchange, as evident from auto-correlation of various orders up to order 10 calculated in Table-1 provides a strong basis for establishing the independent ness of the successive stock prices at the individual levels as well as the aggregate levels. Also the results of run analysis from Table-2 indicates weak form of market efficiency.

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