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INDIAN STOCK MARKET: TEST OF NORMALITY

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ABSTRACT

The assumption of normality plays an important role in finance literature. Modern portfolio theory, for the most part, assumes that asset returns are normally distributed. This assumption is, in fact, quite basic to the use of a variety of statistical methods for investment research and analysis. The assumption of normality is crucial for the validity of the mean-variance analysis. The present paper is an attempt to test the normality of return distribution on Indian stocks. In the present study, the tests of normality on 50 companies stocks from specified and unspecified group, for a period of seven years, is carried out. The test of normality of returns on sample securities and BSE-National Index are tested by standardized measure of skewness (b_1) and kurtosis (b_2). The study found that 35 out of the 50 individual sample securities have significant value of b_1. So, only 15 individual stocks returns are found symmetrical. The study also reveals that all the sample securities have the significant positive kurtosis and BSE-100 Index also has significant positive kurtosis during the study period. The values of b_2 of all the stocks are greater than critical value of b_2, it shows that return distribution on Indian stocks are leptokurtic. It appears from the results that the normal distribution is not a good representation for most of the individual sample securities. Fama (1965) also rejects the normality of stock return. So, we can conclude weekly returns of sample stocks and BSE-100 Index differed significantly from normality. The weekly returns on sample securities during the study period are positively skewed and leptokurtic.

Key Words: Average Return, Skewness (b_1) and Kurtosis (b_2), Variance, Leptokurtic.

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Introduction

The assumption of normality plays an important role in finance literature. Modern portfolio theory, for the most part, assumes that asset returns are normally distributed. This assumption is, in fact, quite basic to the use of a variety of statistical methods for investment research and analysis. The assumption of normality is crucial for the validity of the mean-variance analysis. Over the period of four decades, the normality of return distributions has been extensively tested for the developed capital markets like U.S.A, Australia and Europe. However, there has been a very little testing of this assumption in a developing capital market like India. This assumption is also important to find out the evidence in support of market model and capital asset pricing model. So, the test of this assumption for the Indian stock market is deemed essential because the modern market theory, which assumes normality, is gaining wide acceptance.

The main objective of the present paper is to test the normality of return distribution on Indian stocks.

In India obaidulla (1991) tested the normality of stock market returns. He used Sensex data from April 1979 to August 1991 and Natex data from April 1984 to November 1991. The daily returns were computed as percentage price changes and the monthly returns were computed both as percentage price changes and logarithmic price changes. He found that daily returns of both indexes differed significantly from normality, whereas monthly Sensex returns were not significantly different from a normal distribution. The monthly returns were positively skewed and leptokurtic but not statistically significant. He also found that the deviations were not statistically significant and were less when returns were measured as logarithmic price differences as against the percentage price changes. A study by Obaidullah (1991a) reported that the stock price adjustment to release of value-relevant information is inaccurate. This implies that, at any given point in time, there are undervalued and overvalued stocks in the market. Prices are not equal to their fundamental intrinsic values. Hence, a risk-return parity cannot be expected to hold good. Another study by Obaidullah (1991b) attributes abnormal returns to price-earnings ratios. The abnormal returns are also observed to persist.

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Sehgal (1994) tested the normality of return distributions on Indian stocks over the period from 1984 to 1993. His study comprises monthly returns of 80 securities from both specified and non-specified groups from the period April 1984 to March 1993. These monthly returns had been adjusted for capital changes like bonus, stock splits and right issues. Normality was tested by standardized measure of skewness and kurtosis. He firstly, tested the stability of the yearly means by using a one-way analysis of variances. The F-values were tested at 5% level of significance. Out of 80 securities, he found 15 F-values significant, i.e., non-stable returns. He also tested the stability of variance, by using Hartley's test for homogeneity of variance, and found that 55 individual stocks have significant values. He rejected the hypothesis that the variance of returns distribution remains stable from year to year. He also found, that 64 out of 80 securities had significant positive kurtosis. He also tested normality of return on portfolios by making 10 portfolios of 8 securities, over the 5-year period from 1988 to 1993, and found that all the portfolios had non-normal distribution of return. In sum, he rejected the classical assumption of normality for the Indian capital market during the study period.

Gali (1995) tested the normality of the returns of Sensex, ET index and Natex during May 1987 to June 1994. He constructed daily, weekly, settlement period-wise and monthly returns. Monthly and settlement period wise returns were normal for all the indices.

Data

In the present study, the tests of normality on 50 companies stocks from specified and unspecified group, listed on Bombay stock exchange, are carried out. The study covers a period of seven years from 1st January 1995 to 31st December 2001. Weekend prices of 50 sample companies have been adjusted for bonus issue, right issue, stock split, and stock merger. After that, weekly holding period percentage returns are calculated for further computation. The data for weekly stock prices are obtained from Prowess Database provided by the Center for Monitoring of Indian Economy, BSE website and Business Newspaper like Economic Times, Business Standard, Business Line, etc. The sample of companies is selected keeping in mind that the equity price for the company concerned is available across the time period under consideration. The sample securities, which have been considered, are given in Appendix Table

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with their industry group and symbol. The present paper covers a big chunk of and post liberalization period. The test of normality is also done on BSE-National Index over the same time period as on individual stocks.

Methodology

The test of normality of returns on sample securities and BSE-National Index are tested by standardized measure of skewness (b_1) and kurtosis (b_2).

$b_1=m_3^2/m_2^3$

$b_2=m_4/m_2^2$

Where m_j is the j moment about the mean. For large samples, the significance of skewness(b_1) and kurtosis (b_2) may be tested by comparing b_1 and b_2 –3 with their standard errors, which are given approximately by

$\sigma_{b1}=(6/n)^{1/2}$

$\sigma_{b2}=(24/n)^{1/2}$

If the population is normal, sample value of b_1 and b_2 –3 are not twice as large in absolute value as their standard errors. In the present study the number of observations (n) for every stock is 362. The critical value for b_1 for our sample of 362 observations is $b_1 = \pm 0.2574$ and for $b_2 = 3 \pm 0.5149$.

Results

In table below, we have skewness (b_1) and kurtosis (b_2) of all the sample securities and BSE-100 during the study period. It can be inferred that BSE-100 does not show any significant skewness during the study period. But BSE-100 has positive kurtosis. However, 35 of the 50 individual sample securities have significant value of b_1. So, only 15 individual stocks returns are found symmetrical. b_1 as measure of skewness cannot tell us about the direction of skewness, i.e.,

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whether it is positive or negative. The direction of skewness depends on third moment about the mean (m_3). If m_3 is positive, we will have positive skewness and if m_3 is negative, we will have negative skewness. Only returns on two stocks out of fifty sample stocks have negative value of m_3. Thus, it can be inferred that returns distribution on Indian stocks are positively skewed.

Table: 3 Skewness and Kurtosis of Sample Securities

Symbol	b_1	b_2	Symbol	b_1	b_2
BSE-100	0.01	4.06	S26	0.76	5.12
S1	0.21	4.35	S27	0.48	6.17
S2	0.21	4.69	S28	0.47	4.89
S3	0.40	4.88	S29	0.88	4.98
S4	0.45	4.48	S30	0.01	4.71
S5	0.44	4.48	S31	0.19	4.68
S6	0.05	5.51	S32	0.65	5.08
S7	0.11	3.83	S33	0.00	4.39
S8	0.30	3.93	S34	0.71	4.62
S9	0.13	4.80	S35	0.44	4.51
S10	0.31	5.26	S36	1.97	7.91
S11	0.42	4.48	S37	0.60	4.55
S12	0.15	3.94	S38	0.07	4.12
S13	0.34	4.01	S39	1.57	7.12
S14	0.00	6.38	S40	4.10	11.44
S15	0.03	6.23	S41	0.68	5.40
S16	0.70	4.36	S42	1.22	6.93
S17	0.16	4.12	S43	1.72	8.88
S18	0.51	4.58	S44	0.57	5.95
S19	0.55	5.09	S45	0.64	4.95

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S20	0.98	5.66	S46	0.36	4.70
S21	1.39	7.38	S47	0.80	5.02
S22	0.86	5.81	S48	2.31	8.87
S23	0.67	6.04	S49	0.71	5.59
S24	0.70	5.84	S50	0.06	4.16
S25	0.25	4.01			

For the normal distribution of return, b_2 must be equal to 3. The critical value for b_2 for our sample of 362 observations is $b_2 = 3 \pm 0.5149$. The Table 3 reveals that all the sample securities have the significant positive kurtosis. BSE-100 Index also has significant positive kurtosis during the study period. The values of b_2 of all the stocks are greater than critical value of b_2, it shows that return distribution on Indian stocks are leptokurtic. It appears from the results that the normal distribution is not a good representation for most of the individual sample securities. Fama (1965) also rejects the normality of stock return. To sum up, we can conclude weekly returns of sample stocks and BSE-100 Index differed significantly from normality. The weekly returns on sample securities during the study period are positively skewed and leptokurtic.

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Appendix

Table : Sample Securities with Symbols and their Industry Group

Symbols	Name of the Company	Industry
S1	Ashok Leland Ltd.	Automobile Industry
S2	Bajaj Auto Ltd.	Automobile Industry
S3	Hero Honda Motors Ltd.	Automobile Industry
S4	Kinetic Motor Co. Ltd.	Automobile Industry
S5	L M L Ltd.	Automobile Industry
S6	Mahindra & Mahindra Ltd.	Automobile Industry
S7	T V S Motor Co. Ltd.	Automobile Industry
S8	Associated Cement Cos. Ltd.	Cement Industry
S9	Gujarat Ambuja Cements Ltd.	Cement Industry
S10	Madras Cements Ltd.	Cement Industry
S11	Shree Cement Ltd.	Cement Industry
S12	D S Q Software Ltd.	Computer Industry
S13	H C L Infosystems Ltd.	Computer Industry
S14	Infosys Technologies Ltd.	Computer Industry
S15	N I I T Ltd.	Computer Industry
S16	Rolta India Ltd.	Computer Industry
S17	Satyam Computer Services Ltd.	Computer Industry
S18	Silverline Technologies Ltd.	Computer Industry
S19	Tata Elxsi Ltd.	Computer Industry
S20	Tata Infotech Ltd.	Computer Industry
S21	Wipro Ltd.	Computer Industry
S22	Bombay Burmah Trdg. Corpn. Ltd.	Diversified Industry

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S23	Century Textiles & Inds. Ltd.	Diversified Industry
S24	E I D-Parry (India) Ltd.	Diversified Industry
S25	I C I India Ltd.	Diversified Industry
S26	Kesoram Industries Ltd.	Diversified Industry
S27	Larsen & Toubro Ltd.	Diversified Industry
S28	Tata Chemicals Ltd.	Diversified Industry
S29	Voltas Ltd.	Diversified Industry
S30	Asea Brown Boveri Ltd.	Electrical Industry
S31	Asian Electronics Ltd.	Electrical Industry
S32	Bharat Bijlee Ltd.	Electrical Industry
S33	Bharat Heavy Electricals Ltd.	Electrical Industry
S34	Birla Yamaha Ltd.	Electrical Industry
S35	Crompton Greaves Ltd.	Electrical Industry
S36	Emco Ltd.	Electrical Industry
S37	Honda Siel Power Products Ltd.	Electrical Industry
S38	B P L Ltd.	Electronic Industry
S39	B S T Ltd.	Electronic Industry
S40	J C T Electronics Ltd.	Electronic Industry
S41	Kalyani Sharp India Ltd.	Electronic Industry
S42	Mirc Electronics Ltd.	Electronic Industry
S43	Philips India Ltd.	Electronic Industry
S44	Siemens Ltd.	Electronic Industry
S45	Tata Honeywell Ltd.	Electronic Industry
S46	Videocon International Ltd.	Electronic Industry
S47	Avery India Ltd.	Engineering Industry
S48	Bharat Earth Movers Ltd.	Engineering Industry

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S49	Manugraph India Ltd.	Engineering Industry
S50	Swaraj Engines Ltd.	Engineering Industry