8.1 INTRODUCTION:

Equity shares are increasingly preferred as a medium of investment in India in the 1980s. But the behaviour of share prices has not been comprehensively studied so far, though some attempts have been made earlier. This study is a modest attempt in that direction. This work is mainly concerned with testing the applicability of the random walk theory to the Indian shares prices. Specifically the assumption that successive price changes are independent is tested. In addition, this study examines the lead-lag relationship among shares and the lead-lag relationship among stock exchanges.

The data used in the study consists of:

i) Daily quotations of 75 shares quoted in the stock exchanges of Bombay, Calcutta, Delhi and Madras.

ii) The Economic Times Index of Ordinary share prices (1969-70=100). 19 series of index numbers covering 13 industry-wise indices, five regional indices and an All India/All Industries Index (all daily).

iii) The Financial Express Equity Index (1979=100).

a) All India Index (daily) and

b) week-end index numbers for five regions.

The period of study covers five years, i.e. from April 1, 1982 to March 31, 1987. The daily index numbers cover a period of about four years and nine months. The week-end index numbers used for
analysing the lead-lag relationship among stock exchanges cover four years and eight months.

8.2 ANALYSIS OF DATA:

To examine the main objective namely, testing the applicability of the random walk theory to the Indian share prices, two statistical techniques, viz., Autocorrelation analysis and Runs analysis are used. Daily quotations of 75 shares and daily series of 20 index numbers (13 industry-wise indices, five regional indices and an All India / All Industry Index, all published by The Economic Times and the Financial Express All India Equity Index) constitute the data.

Autocorrelation coefficients are calculated for 1-40 lags (in days). The coefficients exceeding twice and thrice their computed standard error values are identified. Statistically significant coefficients suggest a dependent relationship, while coefficients not significantly different from zero indicate an independence of successive price changes. Runs analysis tests the presence of randomness in the data series. The difference between the actual and the expected number of runs (Z values) are calculated. The Z values statistically significant from zero at 5 per cent and at 1 per cent levels are identified. Statistically insignificant Z values suggest randomness in the behaviour of prices; while significant values show a non-random path of share prices.

Relationship among shares and Relationship among stock exchanges are analysed with the help of Cross-correlation analysis. Specifically, the Cross-correlation tests examine:

i) the lead-lag relationship among shares.
ii) the influence of a particular share traded in one stock exchange over the same share traded simultaneously in some other exchange and

iii) the supremacy of the Bombay Stock Exchange as the price setter for the other exchanges.

Week-end quotations of shares and Week-end Index numbers are used for the Cross-correlation tests. Cross-correlation coefficients are computed for -4 to +4 lags (in weeks) and statistically significant values exceeding twice and thrice their standard errors limits identified. Conclusions are drawn on the basis of degree of significance of coefficients and their signs.

8.3 SUMMARY OF RESULTS AND FINDINGS:

The results are summarised below along with the conclusions derived.

8.3.1 Share Price Behaviour - Autocorrelation Analysis:

The Autocorrelation analysis for individual shares show that the first-order autocorrelation coefficients of 29 shares (39 percent of the sample) exceed twice their standard error values. The coefficients exceed thrice their standard error values for only 16 shares (21 percent of the sample). Thus at 1 percent level of significance, the first order autocorrelation coefficients for 59 out of 75 shares (79 percent of the sample) show a statistically insignificant relationship. Moreover, the coefficients are generally small. The results suggest a predominantly independent behaviour of successive price changes. Even the least traded shares indicate an independent behaviour.
As for the index numbers, four out of 13 industry-wise indices and three out of five regional indices exceed thrice their standard error values. Of these, only two industry-wise indices and two regional indices exceed thrice their standard error values. However, both the All India Index numbers exceed thrice their standard error values and are positive in sign. The dependence exhibited by some of the indices may be due to the 'averaging effect' associated with use of index numbers.

Hence it has been inferred that the successive price changes are independent on the basis of autocorrelations.

8.3.2. Share Price Behaviour - Runs Analysis:

The Runs analysis for individual shares show that a majority of the price series exhibit randomness. The Z and K values are negative for 56 sample shares (75 per cent of the sample), implying that the actual number of runs is less than the expected number of runs. At 5 per cent level, Z value is significant for 22 of these 56 shares. At 1 per cent level, the Z values are significant for only 19 of these shares. The Z values are positive i.e. the actual number of runs is more than the expected number of runs for 19 other shares. At 5 per cent level, only four of these shares are significantly different from zero. At 1 per cent level, only one share shows significance.

As for the index numbers, at 5 per cent level of significance 11 out of 13 industry-wise indices suggest non-randomness. Even at 1 per cent level, nine indices indicate a non-random behaviour. Among the regional indices, four out of five indices suggest non-randomness at the 5 per cent level. At the higher level, three stock exchanges namely
Bombay, Calcutta and Madras show a non-random path. The two all India index numbers show a high non-random behaviour.

Hence it has been inferred that the results for individual shares indicate randomness in their behaviour. However most of the index numbers show non-randomness.

When the results of Autocorrelation tests are considered along with the results of Runs tests, a better understanding about the behaviour of share price changes is possible. When taken together, these results show that only four out of 75 sample shares (5 per cent of the sample) suggest dependence. At 5 per cent level of significance 10 out of 13 industrywise indices suggest an independent behaviour. At 1 per cent level 11 industrywise indices indicate independence. Four out of five regional index numbers show an independent behaviour at 5 per cent level of significance. At the higher level, only the Bombay index showed a negatively significant relationship. However, the two all India index numbers show a dependent and non-random behaviour.

Thus it could be seen that most of individual shares and index numbers show an independent behaviour. Only the two all India Index numbers suggest a dependent behaviour. Hence it has been inferred that successive price changes are independent. So the hypothesis that the successive price changes are independent is accepted.

8.3.3 Relationship Among Shares and Relationship Among Stock Exchanges - Cross-correlation analysis:

Firstly, the lead-lag relationship, if any, among shares is analysed. The notion that ‘leaders’ and ‘laggers’ are discernible among shares is examined. For this purpose, the week-end index numbers for
11 shares quoted on the Bombay Stock exchange are used. The zero-order cross-correlation coefficients show that the share prices are significantly related, either positively or negatively within the one week period. The cross-correlation coefficients computed for \( k = +1, +2, +3, +4, -1, -2, -3 \) and \(-4\) examine the lead-lag relationship among shares. The results show that 72 per cent of the total coefficients exceed twice their standard error values. Almost half of the coefficients are negative. It has been inferred that there are no clear 'leaders', who could influence price changes in other shares consistently. The shares which lead some times, lag in some other times.

Secondly, the price movements of a particular share traded simultaneously in two different stock exchanges are analysed, to find out the kind of influence, if any, between the two price-series. The weekly quotations of Hindustan Motors traded at the Stock Exchanges of Bombay and Calcutta are used for analysis. The zero order cross-correlation coefficient is negatively significant. Coefficients computed for \( k = +1, +2, +3, +4, -1, -2, -3 \) and \(-4\) indicate that the price quotations at the Bombay Stock Exchange lead the price quotation of the Calcutta Stock Exchange after a gap of one and two weeks. But this relationship is not carried beyond \( k = +3\). The coefficients for \( k = -1\) to \(-4\) are negatively significant. On the basis of the above analysis, it has been inferred that price changes of Hindustan Motors traded at Bombay do not influence the price changes of the same share traded simultaneously at Calcutta consistently.

Thirdly, the notion that the Bombay stock exchange is the price-setter is examined. The weekly index numbers for five regions, viz.,
Bombay, Calcutta, Delhi, Ahmedabad and Madras published by the Financial Express are used for analysis. The zero order cross-correlations indicate a high degree of simultaneous movement of all stock exchanges, except Bombay, within the one week period. The coefficients for \( k = +1, +2, +3, +4, -1, -2, -3 \) and -4 show that while the Bombay Stock Exchange influences the other stock exchanges, the other stock exchanges do not seem to influence the Bombay Stock Exchange. However the influence of Bombay Stock Exchange is of a lesser degree only. There exists a significant positive relationship among all the stock exchanges except Bombay, particularly between Calcutta and Madras. It has been inferred that Bombay Stock Exchange influences the price changes in other stock exchanges to a certain extent in setting prices.

8.4 IMPLICATIONS OF THE STUDY:

The results of the study lead to the following implications.

i) It is evident that the equity share prices move, in general, in an independent manner. Hence the Indian stock markets are weakly efficient. So, the random walk theory is appropriate to describe the behaviour of share prices in the 1980s.

ii) The technical analysis which states that the share prices move in trends and patterns is questioned. Fama observes: "If the random walk model is a valid description of reality, the work of the chartist, like that of the astrologer, is of no real value in stock market analysis". This study establishes that the random walk theory is applicable to the Indian share prices. Hence abnormal profits cannot be made on the basis of past prices alone.
iii) The random walk theory does not deny the possibility of forecasting share prices. Fama argues that the fundamental analysis is "...of value only when the analyst has new information which was not fully considered in forming current market prices, or has new insights concerning the effects of generally available information which are not already implicit in current prices." It requires the ability to consistently make projections that are superior to the other analysts, which is difficult to implement.

iv) The lead-lag relationship among different shares show that there are no clear leaders, who could lead the price changes for other shares consistently. Hence trading in certain shares on the basis of movements in some other shares may not give consistently high profits.

v) When a particular share is traded simultaneously in two different stock exchanges, people engage in arbitration. i.e., they compare the prices at the two centres and trade by buying low and selling high. The tests show that arbitration may not yield consistently high profits.

8.5. SUGGESTIONS FOR FURTHER RESEARCH:

The following suggestions are made for further research.

i) Transaction-wise data, if available, can be analysed.

ii) Share prices can be analysed with the help of mechanical trading rules like filter tests.

iii) Share price changes along with their volume of transactions can be taken up for research.

iv) Shares quoted on comparatively smaller stock exchanges like Bangalore, Hyderabad, Cochin etc., can be examined.
v) Daily quotations of shares included in a popular index can be taken and compared with the movement of the index.

vi) For analysing the lead-lag relationship among different shares, most active shares along with the least active shares can be taken up. Similarly the most active shares in one industrial group can be compared with the least active shares in the same group.

vii) The behaviour of share price changes can be tested at the semi-strong and strong levels. For testing the semi-strong form of Efficient Market Hypothesis, the speed of adjustments of share prices to currently released public information are to be taken. To test the strong form, portfolios managed by the Investment Trusts and the Unit Trust of India can be examined with randomly selected portfolios.
Notes and References


2. Fama, 1965b, op.cit.,p.46

3. Yasaswy, op.cit.,p.32

4. Fama, 1965b, op.cit.,p.47

5. Reilly, op.cit., p.204.