CHAPTER II
SHARE PRICE BEHAVIOUR:
A REVIEW OF THEORIES
AND EVIDENCE

2.1 INTRODUCTION

This chapter is presented in two parts. First, the three theories of share price behaviour are discussed. A review of empirical works on the random-walk behaviour of share prices follows later.

2.2 THEORIES OF SHARE PRICE BEHAVIOUR:

Traditionally there have been two theories that explain the share price behaviour. They are (i) Fundamental Theory and (ii) Technical Theory. In addition, the academicians advanced the Random Walks theory which gained prominence since the 1960s. The three theories are discussed below.

2.2.1 Fundamental Theory

According to this theory, share prices are determined by certain fundamental factors. These factors can be grouped as i) Company-specific factors, ii) Industry-relevant information and iii) Macro-economic influences. At any particular time, any one factor or any combination of factors may affect the share price of a company.

Based on these fundamental factors, each share has an intrinsic value. At any time in the market, shares may be over-priced or under-
priced in relation to its intrinsic value. Generally, the over-priced shares are to be sold at the earliest, as their prices will fall when their true value is known to the market; Conversely, the underpriced shares are to be purchased immediately as their prices will go up soon. Constant monitoring and evaluation of shares, in the light of changes in fundamental factors, helps in finding out the over-priced and underpriced shares. Thus fundamental analysis helps in finding out the mispriced shares. This kind of analysis comprises of i) Company analysis, ii) Industry analysis and iii) Economic analysis. Profit and loss accounts of companies, Balance sheets, Annual reports, Policy statements by the Governments, Macro-economic reports and such other relevant information are used for fundamental analysis.

This is the oldest and still widely used technique for analysing the behaviour of share prices. Benjamin Graham of the United States of America had been the advocate of this theory for many years. His book *Security Analysis* is the most popular work on the fundamental theory. The main advantage of fundamental analysis is that it involves no assumptions and only the relevant factors are taken into account for analysis. Its main disadvantage is the inaccuracy of information available for analysis. Companies conceal quite a lot of information, making the whole analysis meaningless. Besides, the fundamental analysis cannot predict the random nature of events that affect the share markets.

2.2.2 Technical Theory

This theory believes that the share prices are determined only by the market forces, viz., the demand for and supply of shares. The term technical
refers to the study of market itself, as opposed to the external factors reflected in the market. Here the past history of trading volume and price data for shares are recorded and their future trend is predicted on the basis of past movements. Edwards and Magee note the basic assumptions of the technical theory as follows:

i) Market value is determined solely by the interaction of supply and demand;

ii) Supply and demand are governed by many rational and irrational factors;

iii) In disregard of minor fluctuations in the stock market, share prices tend to move in trends which persist for an appreciable length of time;

iv) Changes in trend are caused by shifts in supply and demand;

v) Shifts in supply and demand, no matter why they occur, can be detected sooner or later in market action;

vi) Some chart patterns tend to repeat themselves.

In the words of Levy: "... the basic assumption of technical theories is that history tends to repeat itself. In other words, past patterns of market behaviour will recur in future and can thus be used for predictive purposes."

A variety of technical tools are used to analyse the behaviour of share prices. They include charts, graphs and moving averages. Buying and selling of shares is recommended on the basis of signals received from these techniques.
The precursor of all technical principles is the Dow Theory. This is also one of the most popular technical theories. It was originally conceived by Charles Dow during the turn of the century. According to this theory, share prices are classified into three types:

a) Daily fluctuations  
b) Secondary movement and  
c) Primary trend.

According to Dow, "... the market is always considered as having three movements, all going at the same time. The first is the narrow movement, from day to day. The second is the short swing, running from two weeks to a month or more; the third is the main movement, covering at least 4 years in duration." Share prices are predicted on the basis of these movements.

The major weakness of technical theory is that it assumes that the history tends to repeat itself. But actually there is no guarantee that the future will resemble the past. Another shortcoming of this theory is that its approach is more intuitive and psychological rather than scientific.

2.2.3 Random Walk Theory

According to the Random Walk Theory, share prices behave in an independent manner; there is no relationship between the past prices of a share and its future price. Hence, the behaviour of prices is largely unpredictable based on their past history. Fama says, "Most simply the theory of random walks implies that a series of stock price changes has no memory - the past history of the series cannot be used to predict the future in any meaningful way. The future path of the price level of a security is no more
predictable than the path of a series of accumulated random numbers." The main thrust of the random walk theory is that the successive price changes of an individual security are independent over time and the prices fluctuate randomly around the intrinsic values of the securities. The random walk theory is based on the assumption that the successive price changes in an individual security are independent.

The random walk theory assumes that the share markets are efficient, in which there are a large number of active participants competing with each other to predict future prices, and where information is freely available to all. In such a market, the price of a security at any point of time, reflects the effect of information based on all events - past, present as well as future. So the price of a security is considered to be a good estimate of its intrinsic worth. The actions of competing participants in the market cause the actual prices to wander randomly about the intrinsic worth. The intrinsic values themselves can change as a result of new information coming to the market. However, competition will cause the full effect of new information on intrinsic values to be reflected instantaneously in actual prices. The price changes in individual shares are independent and unrelated to past prices.

The random walk theory goes back to the research carried out by the 19th century botanist, Robert Brown whose findings were nicknamed as Brownian motion. Pioneering efforts by French mathematician Bachelier and later, Einstein's diffusion theory contributed to the development of the random walk theory. Bachelier
is credited with the original observation that prices seem to move randomly through time. With the advent of computers, serious research was taken up during the 1950s and 1960s. The results of these studies supported the randomness of price changes and the evidence provided an impetus for the development of a theory to explain their behaviour. As a result, the Theory of Efficient Capital Markets came into existence. According to the Efficient Market Hypothesis (EMH), the security prices adjust rapidly to the new information and the current prices reflect all the information.

Because of the voluminous research that has been done on the Efficient Market Hypothesis, the overall hypothesis has been divided into three segments and each has been tested separately. The three segments are: i) Weak Form, ii) Semi-strong Form and iii) Strong Form. The Weak Form EMH says that stock prices fully reflect all market information and so the past prices contain no useful information to predict future prices. This form of Efficient Market Hypothesis is called the random walk hypothesis because a majority of the tests undertaken to check its validity are tests for randomness in successive price changes. The tests have consistently established that the share prices behave in an independent and random manner. According to the Semi-strong form of the Efficient Market Hypothesis, security prices adjust rapidly to the new information and so all publicly available information is immediately reflected in share prices. Most of the studies undertaken in foreign countries to test the immediate effect of the announcement of new information on share prices support the Semi-strong hypothesis, but...
there are also clear exceptions. Strong form of the Efficient market Hypothesis says that all information is reflected in share prices. Hence no one has monopolistic access to information and so nobody can consistently earn above average profits. The studies undertaken in foreign countries to test the Strong form hypothesis show mixed results.

2.3 REVIEW OF EMPIRICAL WORKS:

French mathematician Louis Bachelier’s work in 1900 is the pioneering study on the random walk behaviour of prices. Bachelier analysed the French commodity prices and found that their behaviour was random. But his work remained largely unnoticed for a long time. Research on the random walk behaviour of security prices gathered momentum only in the 1950’s, with the advent of the computer. Since then a large number of studies have been undertaken particularly in developed countries and especially in America. Research on the Indian share prices started late and only a few studies have been undertaken so far.

Most of the available studies in this area are foreign works, especially American. For a clear understanding, the review of literature is arranged in the following manner:

i) Review of foreign evidence:
   a) American Studies
   b) Non-American Studies

ii) Review of Indian evidence.
2.3.1 Review of Foreign Evidence:

Here the available empirical studies relating to the foreign share markets are reviewed. First the American studies, and then the Non-American foreign studies.

2.3.1.1 American Studies:

The first notable study in the modern period was made by Roberts in 1959\textsuperscript{16}. For analysis, he took the i) Weekly (Friday to Friday closing) changes, and ii) week end closing levels in the Dow Jones Index for 52 weeks during 1956. Then he simulated a set of weekly changes and weekend levels for 52 weeks with the help of random numbers. The actuals and the simulated ones were compared. It was found out that the simulated ones showed an unmistakable resemblance with the actuals. Roberts argued that "probably all the technical analysis can be generated artificially by a roulette wheel or random number table"\textsuperscript{17}. Thus the first salvo against the very concept of technical analysis was fired.

Osborne’s study in the same year, supported the random walk behaviour of prices\textsuperscript{18}. Osborne found that there was a high degree of conformity between the behaviour of share prices and the law governing Brownian motion. Brownian motion is a type of random walk.

The publication of these two papers created a controversy which led to a number of studies on the random walk hypothesis. These studies have used two types of tests for analysis, viz., i) Statistical tests and ii) Trading rule tests. The statistical tests include classical tools such
as auto correlations and runs analysis and a sophisticated technique namely spectral analysis. The trading rule tests focus on the effectiveness of using specific trading rules designed to explain possible systematic patterns in share price movements.

Cootner analysed the weekly prices of 45 stocks from the New York Stock Exchange by using autocorrelations. Mean-square successive differences test was used to test the randomness. The results showed that the autocorrelations for weekly price changes were generally small suggesting a random behaviour. But when the same data was examined for a 14 week interval, share prices exhibited at least some tendency for trends.

Moore examined i) the weekly changes in 30 randomly selected shares traded on the New York Stock Exchange during 1951-58, and ii) a market index with the help of autocorrelation tests. The individual securities showed an independent behaviour while the market index exhibited a thin pattern.

Fama presented a 'strong and voluminous evidence' in favour of the random walk hypothesis. He took the daily prices of thirty blue-chip stocks (included in the Dow Jones Industrial Index) for a period of about five years ending 1962. The serial correlation tests showed that the coefficients for daily changes were very small, the average being +0.026. The serial correlation coefficients were constructed for longer differencing intervals of 4, 9 and 16 day price changes also. These coefficients were
also quite small making Fama to note that "the evidence produced by the serial correlation model seems to indicate that dependence in successive price changes is either extremely slight or completely non-existent".\textsuperscript{23}

Runs tests were applied to the same data for 1, 4, 9, and 16 days differencing intervals. The differences between expected and actual runs were analysed in three different ways. The results supported the random behaviour of share prices. On the basis of these two statistical tests Fama argued that "there is little evidence, either from the serial correlations or from the various runs tests, of any large degree of dependence in the daily, four-day, nine-day and sixteen-day price changes".\textsuperscript{24}

The data was again tested with the help of Alexander's Filter Technique\textsuperscript{25}, to see whether the mechanical trading rules yield more profits than what can be earned under a buy and hold policy. The results showed that when commissions are taken into account, profits are negative for 26 of the 30 securities. Thus, these tests also supported the random walk behaviour of prices. So, Fama noted that "the results produced by the filter technique do not seem to overturn the independence assumption of the random walk model, regardless of how strictly that assumption is interpreted".\textsuperscript{26}

After extensive testing of the data, the author summarised the results thus: "On the basis of all these tests it was concluded that the independence assumption of the random-walk model seems to be an adequate description of reality".\textsuperscript{27}
King tested the behaviour of 63 securities from the New York Stock Exchange, taking their monthly first differences in the logarithm of prices over a total period of 403 months from June 1927 through Dec. 1960\textsuperscript{28}. The average serial correlation coefficient was +0.018 indicating that the price changes followed the random walk model.

The above studies have used two major statistical techniques, viz., serial correlations and runs tests. Granger and Morgenstern have used another statistical technique, viz., spectral analysis to examine the behaviour of share prices\textsuperscript{29}. His tests also showed that the short run price movements in general, followed a random walk.

Apart from the above statistical tests, trading rule tests were also used by the researchers to analyse the behaviour of share prices. These tests examine whether trading strategies based on past price movements provide opportunities for abnormal profits. Specific trading rules, that attempt to generate investment decisions on the basis of past market information, as opposed to a simple buy-and-hold policy\textsuperscript{30} are tested.

Prof. Alexander used a mechanical trading rule called filter technique to identify movements in stock prices\textsuperscript{31}. An $x\%$ percent filter has been defined thus: "If the daily closing price of a particular security moves up at least $x\%$ percent, buy and hold the security until its price moves down at least $x\%$ percent from a subsequent high, at which simultaneously sell and go short. The short position is maintained until the daily closing prices rise at least $x\%$ percent above a subsequent low,
at which time one should simultaneously cover and buy. Moves less than x percent in either direction are ignored. The daily closing ‘prices’ of two US industrial averages namely, the Dow Jones Industrials (from 1897 to 1929) and Standard and Poor’s Industrials (from 1929 to 1959) were taken for the study. Filters ranging in size from 5 to 50 percent were employed. The results showed that, in general, filters yielded profits significantly higher than those that can be earned under a buy-and-hold policy. Alexander concluded that the independence assumption of the random walk model has not been upheld by his data.

In his later work, Alexander retested the earlier data after adjusting for bias factor. The results showed that the filters were not able to outperform the buy-and-hold consistently. The results seemed to suggest that, at least for the individual investor, the filter tests tend to support the independence assumption of the random walk model.

Fama and Blume applied Alexander’s filter technique to a series of daily closing prices for 30 stocks included in the Dow Jones Industrial average. The period of study covers approximately five years ending 1962. 24 different filters ranging from 0.5 percent to 50 percent were employed. The results showed that filter techniques cannot in general perform consistently better than the buy-and-hold policy when transaction costs are taken into account. So the authors opined that “the filter technique cannot be used to increase the expected profits of the investor who must pay the usual brokerage commissions.”
Levy tested several mechanical trading rules based on the technical theory. The weekly closing prices of 200 stocks listed on the New York Stock Exchange for 260 weeks during Oct. 1960-Oct. 1965 were taken for analysis. Several different strategies essentially based on relative strength were employed. On the basis of these results, Levy concluded that "stock prices follow discernible trends and patterns which have predictive significance; and the theory of random walks has been refuted."

Jensen in an invited comment, pointed out that Levy's analysis suffer from several errors. Jensen noted that due to these errors the profits earned by the trading rules were overstated. He also complained that the superiority of his trading rules "is the result of a subtle type of selection bias."

Jensen and Benington subjected two of Levy's trading rules (which seemed to earn substantially more than a buy-and-hold policy) to a different set of data, to see whether Levy's results indicate dependencies in price behaviour or are due to selection bias. The data consisted of monthly closing prices of 200 shares of the New York Stock Exchange. After extensive testing, the authors noted that "Our replication of two of Levy's trading rules on 29 independent samples of 200 securities each over successive 5 year intervals in the period 1931 to 1965 does not support his results." They concluded their work thus: "Given these results we conclude that with respect to the performance of Levy's "relative strength" trading rules the behaviour of security prices on the
New York Stock Exchange is remarkably close to that predicted by the efficient market theories of security price behaviour ...."42. Thus the authors disproved Levy's conclusion.

Van Horne and Parkar examined thirty different combinations of trading rules (three different moving-average rules with five different thresholds under two different categories of trading) on a sample of 30 industrial stocks listed on the New York Stock Exchange43. The sample period was from Jan.1, 1960 to June 30,1966. The results showed that the buy-and-hold strategy is overwhelmingly superior to the various mechanical trading rules. So, the authors concluded that "the evidence of this paper supports the random-walk theory of price behaviour in the stock market"44.

Thus the evidence produced by the various statistical as well trading rule tests establish that successive share price changes in American Stock Markets are generally independent and random. The random walk theory holds good for these shares and past price history provided little help to predict future prices. Even the securities traded on Over-the-counter (OTC)45 market showed an independent behaviour of price changes. A study by Hagerman and Richmond made with the help of serial correlation and runs tests showed that "price changes are serially independent which is consistent with the random walk hypothesis"46.

2.3.1.2 Non-American Studies:

Early in 1950s, Kendall made a notable study on the British Stock prices47. He examined the weekly changes in nineteen indices of British
Industrial Share Prices along with two American commodity spot price series. The analysis of serial correlations showed that each series of price changes appeared to be a wandering one. The price behaviour was independent of past price movements.

Dryden analysed three daily indices of British shares with the help of serial correlation tests and filter tests. The first order serial correlation coefficients were significant, while most of the higher order coefficients were insignificant. The filter rule tests did not support the random walk theory. In another study, Dryden examined the daily closing prices of 14 British shares with the help of serial correlation tests, runs tests and filter tests. The results of all the three tests supported the random walk hypothesis.

Solnik tested the adequacy of the random walk hypothesis for European Stock prices with the help of serial correlations. The daily prices of a sample of 234 securities from eight major European Stock markets, viz., France, UK, Germany, Italy, The Netherlands, Belgium, Switzerland and Sweden were taken up for the study. The data period covered March 1966 through April 1971. The serial correlation coefficients were quite small. "No important deviations from the random walk are found." However, the results indicated "a lesser efficiency of most European Stock Markets" than the US markets, probably due to the technical and institutional characteristics of European Capital Markets, such as thin markets, poor disclosure of information, discontinuity in trading and no control on insider's trading.
Studies by Niarchos on Greek Stocks\textsuperscript{54} and Praetz on Australian Stocks\textsuperscript{55} supported a random behaviour of prices in general.

Conard and Juttner examined the German share prices and found that their behaviour was non-random\textsuperscript{56}. Jennergen and Korsvold tested the Norwegian and Swedish share prices and revealed a similar result\textsuperscript{57}.

Aug and Pohlman found that the Japanese share prices exhibited a high degree of randomness\textsuperscript{58}.

Thus, it could seen that studies relating to most of the Non-US foreign markets also supported the random walk theory of prices. These markets are substantially efficient in the weak sense. However, "the evidence relating to smaller and developed stock markets is considerably thinner"\textsuperscript{59}. The extent of research on these markets have increased in recent years. The results of these studies indicate that "the evidence relating to the smaller markets is, ..., somewhat inconclusive..."\textsuperscript{60}.

2.3.2 Review of Indian Works:

Research on the behaviour of Indian share prices started late on a modest scale and only a few studies are available for reference. Rao and Mukherjee examined the weekly averages of the daily closing quotations of one particular company's share for the period 1955-70, with the help of spectral analysis\textsuperscript{61}. The results showed no evidence contrary to the random walk hypothesis.
In a major study, Sharma tested the applicability of the random walk theory to the Bombay Stock Exchange. For this purpose, two sets of data were used: i) the monthly observation of a) Bombay Variable Dividend Industrial Securities Index (BVDISI) published by the Reserve Bank of India, b) the London Financial Times Actuaries Stock Index and c) the Standard and Poor Index of the New York Stock Exchange, and ii) the weekly friday quotations of 23 stocks included in the specified list of the Bombay Stock Exchange for the period 1963-73. Serial correlations, Runs tests, Spectral analysis and the Auto-regressive integrated moving average (ARIMA) forms for random walks as suggested by Box and Jenkins were used for analysis. The analysis of monthly index numbers showed that i) there were no sufficient differences in the general behaviour of the 3 stock indexes, ii) the random walk model appeared to be an adequate representation of the Bombay Index's behaviour. The analysis of weekly prices of shares also confirmed the results established by the behaviour of the Bombay Index. Based on the results, Sharma concluded that "...the stock price changes in Bombay Stock Exchange conform to random walk model". In a paper, Sharma alongwith Kennedy comparatively analysed the stock price behaviour of Bombay, London and New York Stock Exchanges. In the concluding lines the authors noted: "it is evident that stocks on the Bombay Stock Exchange obey a random walk and are equivalent in this sense to the behaviour of stock prices in the markets of advanced industrialised countries examined in this article."
Later, Suresh Kulkarni analysed 18 series of different weekly and monthly index numbers - regional, industry-wise and All India -, published by the Reserve Bank of India with the help of spectral analysis. The data period varies for different indices and covers periods during 1947-48 and 1972-73. Kulkarni identified "a repeating cycle of four weekly prices and seasonality in monthly prices". The results indicated a non-random behaviour in share price changes.

Barua examined the daily price movements of shares for the first time along with that of an index number by using serial correlations and runs tests. Daily closing quotations of 20 different shares from three different stock exchanges for a period of two years, from July 1977 to June 1979, were taken for the analysis. The auto correlations computed for 1 to 8 lag periods showed that only 17 values out of 168 are significant at 5 percent level. The Z scores in the runs tests indicate that only the market index and one security showed a non-random behaviour of price changes at 5 percent level of significance. The market index exhibited a non-random behaviour while the securities showed independence of price changes. Barua noted that the "results support the null hypothesis of serial independence of price changes of securities".

O.P. Gupta in a noted study tested the applicability of the random walk hypothesis to the behaviour of Indian share prices during 1971-76. The Friday quotations of 39 'active' shares, 41 series of weekly industrywise index numbers published by the Financial Express, the daily industrywise index numbers published by the Economic Times for 13 industries and two all India daily index numbers published by the
Financial Express and the Economic Times comprised the data. Serial correlations and runs tests were used for analysis. For the 39 shares, "The empirical evidence produced by both the serial correlation and runs analysis strongly support the random walk model". The behaviour of a majority of the industrywise indices also lent support to the random walk hypothesis. But the random walk model was not upheld for a few industrywise indices and the two all India index numbers. However, the degree of non-randomness in these cases was weak. In sum, "both the tests - serial correlations and runs analysis - generally supported the independence assumption of the random walk model". Hence, Gupta concluded that the Indian Stock Exchanges are 'weakly efficient' in pricing shares. The study further examined the 'lead-lag relationship' between the price series of 39 shares. The purpose of the analysis is that if price changes in some shares lead the price movements of other shares, then one can trade in lagging shares on the basis of movements in leading shares and make a profit. The empirical results showed that leads and lags were not discernible in majority of the instances and none of the shares appeared to be a strong leader. Gupta notes: "...contrary to widespread belief, there are probably no leaders and laggers in the market".

The review of Indian evidence shows that except one study by Kulkarni, all other studies have supported the random walk behaviour of share price movements. The following points emerge from the above review:

i) Much of the evidence is based more on the movement of stock market indices than on the movement of individual shares. All the
above studies except the one by Barua have used either a) index numbers, or b) weekly price quotations or both. But actually the use of index numbers might affect the results of the study. O.P. Gupta notes: "the use of Index Numbers appear to be the most obvious weakness in many of the earlier studies of the random walk behaviour." Weekly quotations do not really reflect the price changes occurred during the entire week. Moreover, less number of transactions during week-ends may affect price changes abnormally on those days.

ii) Mainly shares traded on the Bombay Stock Exchange have been used for analysis. Shares traded on other stock exchanges haven't been examined enough so far.

iii) The studies have confined their scope to the active shares only. Not-so-active shares have not been properly analysed. Only Barua has included some not-so-active shares in his sample.

iv) The evidences relate to the behaviour of share prices during the 1940s to 1970s. The price behaviour in the 1980s, during which the entire Indian stock markets have grown enormously, has not been taken up for study so far.

Considering these facts, it is felt that a study which examines the daily price changes of both the active as well as not so active shares, traded on the country's different stock exchanges during the 1980s, can give a comprehensive and better view about the behaviour of Indian share prices. Hence this study. This study examines daily prices along with daily Index numbers. In addition to testing the behaviour of shares for independence and randomness of price changes, this work also
examines the lead-lag relationship among different share price series and among different stock exchanges. Though Gupta has examined the lead-lag relationship among different share price series, the influence of the price changes of a particular share traded simultaneously in two different stock exchanges is examined here for the first time.
Notes and References:


5. Other tools include: Odd-lot statistics, short interest ratios, breadth indexes, statistics on highs and lows and relative strength measures.


8. Another assumption of the theory of random walks is that the price changes conform to some probability distribution. Fama, 1965a, notes that of the two assumptions the independence assumption is the most important one. As for the distribution assumption, Fama points out that “...any distribution is consistent with the theory as long as it correctly characterizes the process generating price change.” (Fama, 1965a, p.41)

9. Brownian motion describes the irregular movement of small particles suspended in a gas or liquid. The movements may be of different magnitudes and may occur at any time independent of any prior movements.


11. The Theory describes the random motion of gas molecules in collision.


14. Reilly, op.cit., p.203

15. Since the scope of the study is confined to testing the random walk hypothesis (or the weak form efficient market hypothesis) only, the review does not take into account the studies relating to the semi-strong form and strong forms of the efficient market hypothesis.


17. ibid., p.4.


19. Spectral analysis is the decomposition of time series into a set of sine or cosine waves with different amplitudes, frequencies and phase angles.


23. ibid., p.74

24. ibid., p.80

25. Explained in Page No. 2.1

26. Fama, 1965a, op.cit., p.85

27. ibid., p.90


30. Buying a stock at the beginning of a test period and holding it to the end.


32. Fama, 1965a, op.cit., p.81


35. ibid., p.236.


37. ibid., p.76


39. ibid., p.84.


41. ibid., p.481.
42. ibid., p.481


44. ibid., p.92

45. Over-the-Counter market refers to trading of securities off the floor of the stock exchange.


51. ibid., p.1151

52. ibid., p.1152

53. ibid., p.1152


60. ibid., p.48


63. ibid., p.229.


65. ibid., p.411


67. ibid., p.159.

69. ibid., p.96
70. O.P. Gupta, op.cit.

71. ibid., p.142
72. ibid., p.109
73. ibid., p.131

74. The effect of Index numbers on the autocorrelation results is explained in Chapter V

75. O.P. Gupta, op.cit., p.53