PREDICTABILITY OF SHARE PRICES IN INDIA:

A STUDY OF
THE APPLICABILITY OF TECHNICAL ANALYSIS

Thesis Submitted

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SAJEEVE V.P.

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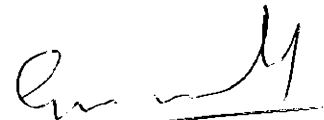*Under the Guidance and Supervision of*

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CERTIFICATE

Certified that the thesis entitled "PREDICTABILITY OF SHARE PRICES IN INDIA: A STUDY OF THE APPLICABILITY OF TECHNICAL ANALYSIS" is the record of bonafide research carried out by Mr. SAJEEVE V.P. under my guidance and supervision. The thesis is worth submitting for the award of the Degree of Doctor of Philosophy under the Faculty of Social Science.
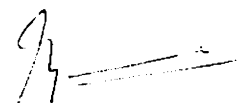
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DECLARATION

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TABLE OF CONTENTS

Abbreviations

List of Charts

List of Figures

List of Tables

Bibliography

Appendix- Definition of Terms used

ABBREVIATIONS AND ACRONYMS USED

σ	Sample Standard Deviation
Σ	Summation
B1	First Bottom
B2	Second Bottom
B3	Third Bottom
Br.	Breakout Price Point
BSE	Bombay Stock Exchange
DMA	Days Moving Average
DJIA	Dow Jones Industrial Average.
EMA	Exponential Moving Average
FW	Falling Wedge
H	Head Point
HP	Holding period
HSB or Hsb	Head and Shoulders Bottom
HST or Hst	Head And Shoulders Top
IAT	Inverted Ascending Triangle
IDT	Inverted Descending Triangle
IST	Inverted Symmetrical Triangle
LS	Left Shoulder
LSE	London Stock Exchange
MA	Moving Average
MACD	Moving Average Convergence Divergence Index
N	Number of Observations in the Sample

NL1	First Point of the Neckline
NL2	Second Point of the Neckline
NYSE	New York Stock Exchange
P	Price
p	Proportion
P.O.	Price Objective
p.	Page
pp.	Pages
ROC	Rate of Change
RS	Right Shoulder
RSI	Relative Strength Index
RW	Rising Wedge
S.E.	Standard Error
Sqrt	Square root
ST	Symmetrical Triangle
Std.dev.	Sample Standard Deviation
Stoch.	Stochastics
T1	First Top
T2	Second Top
T3	Third Top
W	Weight
WMA	Weighted Moving Average

LIST OF CHARTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER –I

INTRODUCTION

CHAPTER - I

INTRODUCTION

Research premises

The utility and futurity of technical analysis have long been a controversial point among stock market players, analysts and others including the academics in the field. Some of them hold its validity while others take it with great scepticism. The number of investors and finance professionals using it, interested in it or concerned about it is increasing day by day. This is evident from the facts such as (i) increasing number of books and other publications exclusively dealing the subject in the market, (ii) the increasing number of releases and installations of the computer software (Computrac, Metastock Professional, Capitaline, Omni Trader, The Technician, etc.), (iii) the charting and other services available at broker offices and 'online' facilities through internet, (iv) the increasing number of publications, (v) inclusion of the topic in the syllabus of various courses on 'finance' and 'security analysis' in universities, colleges and other centres of higher learning, (vi) the increase in the number of technical tools and indicators as developed by practitioners, (vii) availability of 'video courses' from various private agencies, etc. However most part of the related academic literature has given technical analysis a bad name.[1] There is practice of technical tools on one side. On the other side, the research findings hold its validity as time specific and market specific. That is, technical analysis is valid only at one time period of the market but not other times. For example, it had worked in the Wall Street in 1850 and in Tokyo in 1990[2]. Later there were evidences against its validity in the same markets brought by Fama (1965) Paul Cootner (1964), etc. So it is proved valid in some markets, futile in others and there are markets where it has not yet been tested. Again studies prove the

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[1] Bauer Jr. Richard J. and Dahlquist Julie R., Technical Market Indicators: Analysis & Performance John Wiley & Sons, Inc. New York the USA., (p vii), (1999)

[2] 1. Pring J., Martin, 'Technical analysis explained' McGraw-Hill, (1991)
   2. The Wall Street Journal (editorials) (various issues 1900-1929)
   3. Rhea, Robert, Dow Theory, Barrons, New York, (1932)

validity of some of the technical analysis and tools in some of the markets but neither all of the technical tools, nor in all the markets.[3] So time and market are the two most relevant things disregarding which nobody can confirm the validity or otherwise of technical analysis. There are many market participants including professionals in India, and even in other developed markets, who use technical analysis. It is paradoxical to the holding of futility of this type of analysis.

The problem here is: why do they practice technical analysis if it is truly futile? The widespread use of technical tools, sparing resources, leads to support the belief that there is benefit in using it. Then there is also suspicion of its use and benefits there from. It requires a rigorous and unbiased examination and an objective testing to determine the consistent validity of this analysis. It is required in India and other capital markets of the world where the validity or futility of technical analysis has not been proved or disproved in respective times and contexts.

[3] 1. Levy, Robert A., 'Relative Strength as a Criterion for Investment Selection'. *The Journal of Finance*, Vo. XXII No. 4. December, (1967)

2. Treynor, Jack L., and Ferguson Robert, 'In Defence of Technical Analysis', Journal of Finanace, (July 1985)

3. Robert Ferguson, "Active Portfolio Management-How to Beat the Index Funds", Financial Analysts Jouranal, (June 1975).

4. Jack L. Treynor and Fisher Black, "How to Use Security Analysis to Improve Portfolio Selection", Journal of Business (January 1973).

5. Ying C.C., "Stock Market Prices and Volumes of Sales", Econometrica (July 1966).

6. Allen H, Taylor M.P. "the use of technical analysis in the foreign exchange market", Journal of International Money and Financ (1999).

7. Levy, Robert A., "The predictive significance of five-point patterns", The Journal of Business, (1971).

8. Osler, C.L., "Identifying noise traders: the head-and-shoulders pattern in U.S. equities", Federal Reserve Bank of New York Working Paper (1998).

9. Dempster MAH, Jones C.M. "Can Technical Pattern Trading be Profitably Automated?", Centre for Financial Research, Judge Institute of Management Studies, University of Cambridge, Working Paper (1998).

10. Chang PHK, Osler CL "Methodical Madness: Technical Aanalysis and the Irrationality of Exchange-rate Forecasts", Economics Journal, (1999).

11. Taylor, Mark P.and Allen H., "The USE of Technical Analysis in the Foreign Exchange Market", Journal of International Money and Finance, (1992).

12. Pring, Martin J; 'Technical analysis explained' McGraw-Hill, (1991).

13. Blume, Lawrence Easley, David and O'Hara, Maureen, "Market Statistics and Technical Analysis: The Role of Volume", *Journal of Finance*, (Mar., 1994).

The Essential Idea of Technical Analysis

Technical analysis aims at prediction of future price from the past trading data of an asset or assets. 'Pattern Study' and 'Indicator Analysis' are the two major areas of technical analysis. Patterns are traditional tools where as indicators are emerging ones. Patterns are price configurations (reflecting market action) in stock charts whereas indicators are price and volume derivatives expressed in graphic or numerical form. Patterns give more visual effect to market action and facilitate easier and quicker memory of past prices.

According to the traditional view, once a pattern configures in a stock chart, it forecasts the immediate post-pattern price behaviour. The view holds that, after each pattern, price moves in a 'certain direction' and to a 'certain extent'. So if a pattern re-occurs, the next price behaviour is forecast from the pattern itself. The signal to action is triggered when the price goes-up or down- beyond the boundary of the pattern. The traditional chart analysts have identified several patterns each having its own price objective. So, every occurrence of, or breakout of price from, a pattern can be taken as a signalling tool. If this view works always, investment performance can be improved by identifying patterns in the concerned stock chart and acting accordingly. This is the simple idea about the use of patterns in the traditional view.

In the pattern analysis part of technical analysis, recurring nature of patterns is the base for price prediction. If patterns do not appear at all indicating that prices move in a perfectly random fashion, and then, prediction from past trading data is not possible. Again, unless patterns repeat and give signal to action as held traditionally, then also price prediction is not possible. Once predicted, the price should move in the direction and to the extent forecast. If this happens, the pattern is a successful one and otherwise failed. Another traditional holding is that the trading volume is an indicator of investor psychology and hence past volume also influences

future prices. So whether success or failure of a pattern is dependent of the volume is another question.

Technical indicators are used to identify turning points in prices. They trigger signal when the indicator value reaches or crosses or comes back to a certain level. They may be used jointly or with or without the signals from patterns.

Relevance Of Technical Analysis In Indian Stock Market

The validity technical analysis depends on the impact that the various features of the market (not much fundamental to any particular stock) have on the stock prices and trading volume. These features include investors' perceptions, provision for dissemination of investor information, analytical power of the investors, availability of sophisticated tools including computer and the requisite software for data processing, trading conditions, quantity of floating stocks, transaction cost including commission, taxation policies, continuity of trading, absence of price administration by government or any other agency, presence of reasonably large number of rational investors, etc. Some of these can be common to all markets while others can be unique. Indian stock market is no exception but not all of them time tested. It means that Indian stock market may have features that make technical prediction valid or invalid at one time or later depending on the condition of the above factors. This chapter examines those features, which can possibly make technical analysis valid and feasible in Indian stock market. Here, it is made clear that these features have never been proved or disproved as contributory to the efficacy of technical analysis. There is also no such presumption, in this study, that they are contributory or otherwise though some of them make technical analysis more feasible and easier. But what is sure about these factors is that all of them are related to the basic conditions for the working of EMH and RWH. So if these factors do not prevail in the manner that EMH and RWH assume them to be, then there is chance for market inefficiency and consequently scope for technical analysis. The

unique nature of technical analysis can capture the advantages of, and address the problems resulting from these market features.

Features Of Indian Stock Market For Technical Analysis

The study identifies the following features of Indian stock market as are relevant while considering the applicability of technical analysis as a predictive tool of stock prices in the market. Each of them is explained so as to show why technical analysis is relevant for dealing in any stock.

i. *Inaccessibility to timely Information* - Fundamental analysis requires information on working results, financial position and various other matters. Data published by the company are not enough. They contain window-dressing and secret reserves.[4] Despite unequal accessibility, timely collection and analysis of information is highly cost-prohibitive to most of the investors. There can be 'early bird' advantage to some including insiders. E.g. even an unusually bulky purchase or sales order can be effectively used before they are published. The uninformed group loses by such actions of the informed class. However, they cannot hide the demand and supply. The result of these (except off-market deals-`mentioned in the 'limitations' of this study) will be fully reflected in the market price and the volume thereof. Thus, it is only through the market that one can discern any of the changing behaviour of the stock price irrespective of the causes there of. What the technical analysts consider is the market data, which is the net effect of all the price sensitive forces and the investor behaviour.

ii. *Poor Liquidity* - There is no continuous formation of prices for all the listed stocks. The market provides liquidity only for the shares of outstanding reputation and quality. When all concentrate on such stocks, speculation

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[4] Window dressing means showing a financial position rosier than actual. Eg. Overstating assets understating liabilities. Secret reserve is the opposite way.

thereon becomes easier because of high demand at one time and large supply at another time resulting in abrupt price fluctuations and irregular crises. They occur without corresponding changes in fundamental values of the concerned share. Therefore, 'why prices change' is no more an accurately quantifiable question. Of the variables, the market trading data are the perfect reflectors of all the changes in the demand and supply forces of any stock. Therefore, it is the market data that should be evaluated to understand what actually happens to it. If these changes are not in conformity with what is generally made known through published data, that points towards market inefficiency where technical analysis has an important role identify the true picture and thus, and there from, to probe the future moves.

iii. ***Scarce floating stock and rampant speculation-*** There exists high elasticity of prices to demand and supply owing to the scarce floating stock in the Indian stock market. The scarcity results from factors such as (a) large inter-corporate investments, (b) net buying position of financial institutions[5], (c) traditionally conservative and sticky portfolios of households, (d) promoters' quota, etc. A small adjustment in the demand or supply position of such stocks would cause large price movements. This provides opportunities for speculators. The prices move between bottom and top positions without any reference to the changing intrinsic value. These positions can be identified only through a continuous follow up of consecutive market figures. The stock-charts used by the technical analyst give the best memory of the prices, reveals whether speculators are on the demand side or on the supply side and thus help to probe the prices.

iv. ***Working of big operators theory*** - Indian stock market has been a victim to many manipulations. The 'smart money group'- including speculators and financial institutions, influences markets at times. Their large holding and huge fund position are influential. The crowd used to follow them. Unlike in

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[5] Research and Publications, www.bseindia.com

the U.S.A. and in the U.K., the number of these entities in India, though increasing, is too small to compete reasonably for the best price. A network of these operators is at an advantageous position that the crowd psychology as a whole cannot be changed so easily as theirs. Their huge buying or selling may make the market buoyant or depressed. Such positions are quite irregular and never correspond to any of the changes in the intrinsic values.

The market situations created by these operators differ from that created by the public in respect of their future significance. The former is more likely for a quick reversal. It is because the latter results from the change in the attitude of the investor mass and the change in such a case is likely to be more gradual and extensive and also that the tendency is widely spread. The market positions created by the big operators relate to the outcome of an individual decision (fund manager) which cannot be smelt in any case until they are executed or sometimes never. Only through the study of market data, such changes in the holding positions (irrespective of their causes) can be fully discerned. Such changes occur not only due to the actual changes in the intrinsic values but also due to the concerted actions of the big operators. In that respect it is the technical analysis that brings to light the full picture of sensitive areas (stocks) of the market irrespective of the causes thereon.

v. *Disproportionate and high cost of information and lack of professional skill-* The complexity of the data on the fundamental and other factors that influence the share prices necessitates the application of the sophisticated techniques to ascertain the intrinsic values. Again, to a vast majority of investors these data are unaffordable and too costly. The delay in getting the relevant pieces of information, the lack of analytical skill and shortage of tools and equipments including computer, result in delayed execution of their investment decisions, which are rarely appropriate. As far as the financial institutions or big operators are concerned, the collection, compilation and analysis of price sensitive data on the company, the industry and the economy from various

sources are comparatively easier and cheaper because of their large resource position, bulky transactions and their generally dominant nature. What are available to the vast majority of investors are the market prices. They are available even in the dailies. Technical analysts use these market figures to predict the future prices. There fore, analysis of market statistics is more practical especially when only minimum amount of time, labour and other resources is available and also when sophisticated tools and systems are not available.

Majority of the brokers in India lacks professional skill and expertise to provide adequate guidance and counsel to their clients[6]. In the U.S.A. and the U.K., brokers form firms and companies and pool their knowledge and expertise for providing their clients with specialized analytical projections. Even though it is a matter of great controversy whether analyses would always assure great fortunes, it is a fact that analyses rationalise the investor behaviour. Unfortunately most of the Indian brokers retain their individual identity. Since the skill and resources goes scattered, the services become costlier. Inadequate specialization hampers the accuracy of prediction. Who wins the game is the clairvoyant. Technical analysis is affordable even to the less skilled and those with only limited resources because it takes only the market statistics. It is the best suited to those having small resource of time, money etc. and those who cannot have much access to insider information.

vi.   *Absence of functional specialization of the members of exchanges*- The members in the Indian stock exchanges can act as either dealers or brokers or both. There is no legal compulsion on them to act in either capacity. This provide ways for them treat the deal as for themselves in the dealer capacity or in agency which ever is profitable to them and, thus, to overcharge the clients. The only requirement is that whenever they deal with non-members

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[6] M.R. Mayya, "Reflections on the Changing Scenario of the Indian Stock Markets", Working Paper, Bombay: AD Schroff Memorial Trust, 1995.

that should be specified. They thus exploit 'market orders' or all other orders where they have discretion. Such conditions affect efficient pricing of the security and continuity of prices.

vii. ***Grouping of listed stocks-*** All the stocks listed are grouped into many. The inter-group reshuffle of stocks changes the market dynamism. In respect of trading, one group has some privilege or disadvantage over the other groups. This itself cause some security more or less efficient than what it ought to be. For example, carry forward dealing is permitted only on the shares in certain Group and also they were eligible for clearing and settlement system of the exchange. These privileges make them more speculative than those in the other groups. So it is the possibility for speculation that decides the prices and not rationality. Shifting of a stock from one group to another, for example, is a price sensitive matter. The first Group dominates in trading volumes and the extent of price changes. These things are clearly discernable only through analyzing the trading statistics as used by the technical analysts.

viii. ***Manipulation through Insider Information-*** Insiders in government, stock exchanges and other regulatory bodies and companies used to manipulate price sensitive policies, decisions, regulatory steps and information on working results. The consequences are more chronic in Indian markets as the deprived victims number in majority who are miss-guided, ill-informed and cheated. So market is unable to recognize efficient assets at the best (equilibrium) price in time. However, if changes in prices are any clue, it will be caught by the technical analysis.

The above-mentioned features provide ground for the consideration of a least cost and easier method of analysis so as to rationalize the investment decisions. So long as they are present in any market that much inefficiency shall prevail in the market and no security would be dealt at its right price.

Problem

In spite of the far longed practices of technical analysis by many participants in Indian stock market, none have arrived at the exact position of technical analysis as a tool for foretelling share prices. There is no evidence supporting that one has established its definite role in predicting the behaviour of share price and also to see the extent of validity (how far reliable) of technical tools in Indian stock market. The problem is the vacuum in the arena of securities market analysis where an unrecognised tool is practised, i.e., whether to hold on to technical analysis or to drop it. Again, as already stated in this chapter, its validity need not continue forever. It may become futile as happened in developed markets. Continuous practice of a tool, which is valid only during discontinuous times is also an error. The efficacy of different market phenomena in terms of their ability to foretell the extent and direction of the price movements and reliability thereof remain as not yet proved in. This requires further study in this area so that this controversy may be settled. A solution to the problem requires enquiring and establishing the applicability of technical analysis, if any, there is in the Indian stock market.

There are several studies in India either supporting or rejecting several aspects of random work hypothesis and fundamental analyses. The question of the efficacy of technical analysis in Indian stock market is still unrecognised. No one has revealed the exact influence that the results of these analyses make in investment decisions. If the findings of this study prove the validity of technical analysis, it should mean that the unique features of Indian stock market have some bearing on every decision on investment in Indian stock market. Also if technical analysis is proved to be potent and reliable, that will help the market players for a wise trading. Therefore, individuals, institutions and business corporations participating in the Indian stock market can take technical analysis as a premonitory tool for investment success.

11

Objectives of the study

The study has the following two broad objectives for the purpose of confirming the applicability, if any, of technical analysis in the Indian stock market. The first objective is to ascertain the current validity of 'traditional holding with respect to patterns' and the second objective is to ascertain the 'consistent superiority', if any, of technical indicators over non-signal strategies in return generation.

The study analyses the five patterns, which are widely known and commonly found in publications. They are: (1) Symmetrical Triangles, (2) Rising Wedges, (3) Falling Wedges, (4) Head and Shoulders Top and (5) Head and Shoulders Bottom. For ascertaining the current validity of these five traditional patterns, the first broad objective mentioned above is divided into the following sub-objectives:

1. To ascertain the occurrence of patterns in the stock chart of Indian companies,

2. To ascertain the trend-wise difference in the frequency of patterns,

3. To ascertain whether patterns generate valid signals for action-buy or sell,

4. To identify the direction of, and measure the extent of, the post-pattern price behaviour,

5. To ascertain the probability of successful patterns,

6. To ascertain the behaviour of volume during pattern formation

7. To ascertain the relationship between success or failure of patterns and the price behaviour inside them.

Along with this, the study's second broad objective is to examine whether there is any scope for signal strategies using Technical Indicators to result in a return superior and consistently superior to the return earned by trading without any analysis, particularly the 'buy and hold' strategy. For evaluating the technical

indicators for their superiority and consistency, the five very commonly used and widely known indicators such as (1) Moving Average, (2) Moving Average Convergence Divergence Index, (3) Relative Strength Index, (4) Stochastic and (5) Rate of Change are examined. If signal strategies using a technical indicator outperform any of the non-signal strategies, then the indicators can be taken as signalling tools for better investment performance.

Hypothesis

For patterns and indicators, separate hypotheses are formed.

As the traditional patterns are examined to ascertain their 'claimed validity' in the Indian stock market, the study moves with the following five hypotheses, which are a split up of the major assumption that traditional patterns achieve their traditional price objectives.

1. "Symmetrical Triangle patterns achieve their traditional price objective."

2. "Rising Wedge patterns achieve their traditional price objective."

3. "Falling Wedge patterns achieve their traditional price objective."

4. "Head and Shoulders Top patterns achieve their traditional price objective."

5. "Head and Shoulders Bottom patterns achieve their traditional price objective."

As the technical indicators are examined to ascertain their ability to generate consistently superior return, the study works on the following hypothesis with respect to technical indicators.

"Signal strategies using *technical indicator* generates a return consistently greater than that from non-signal strategies." This hypothesis is

13

tested for each indicator. Then the words 'technical indicator' in the above hypothesis shall be replaced by the words 'Moving Average Series', 'Moving Average Convergence Divergence Index', 'Relative Strength Index', 'Stochastic' and 'Rate of Change Index' in respective cases when each indicator is analysed and evaluated in Chapter Four.

Consistency is confirmed if result of the experimental period is supported by the result of the testing period.

Methodology

The study analyses the historical data for a period of fourteen years beginning with 1st January 1990, on the trading history of certain selected shares listed in the Bombay Stock Exchange (here in after referred to as BSE). BSE was selected, as data on transactions for such a long period chosen for analysis were available only from it. The period was so selected as to cover all phases of at least one market cycle-bullish, bearish and stagnant phases- so that it may be possible to offset the impact, if any, of different phases of market performance in the prediction process.

The trading data (such as the day's opening price, highest price, lowest price, closing price, and the volume thereof) are obtained from the Official List of Quotations of BSE in the initial stages and by 'online updating' as the BSE started online publication thereof. The stock chart preparation for pattern identification is done in Metastock (Equiz International, the USA). The numerical calculations after identification of patterns and the whole analysis of technical indicators were done using MS Excel Spread Sheet.

The stock charts are examined to identify the possible definite patterns, if any. The patterns and the movement that follows each pattern are examined for ascertaining their usefulness in predicting the post-pattern behaviour in terms of the direction as well as the extent of movement.

14

The relevance of volume in the prediction process is ascertained by comparing the success or failure of the predictions with varying relative volume.

The different steps in the methodology included the following:

Sample Design

Multi-stage sampling technique was applied for selecting the sample. All the stocks as were listed on Bombay stock exchange as on 31st December 1996 form the broad universe of the study. Regularity of trading' and 'volume sufficiency' are pre-requisites for technical analysis[7]. They ensure continuity of price formation. They are essential for confirming some of the technical signals as valid and to act upon. So actively and continuously traded stocks as revealed by their trading history up to 31st December 1996 (mid-point of the data period) are selected to form the final list where from ten stocks were selected at random. Regularity of trading was measured by the number of days during a year the stock had been quoted and traded on the exchange where as volume is taken as the base to select the actively traded stocks. The final list of companies for detailed analysis was prepared in the following manner.

There were data on 3400 companies. Firstly, this list was screened for regularity of trading and it reduced the number of stocks to two hundred and seventy (270). At the second stage, these two hundred and seventy companies were further screened based on activity (volume) of trading and the most actively traded fifty (50) stocks were selected. Form this list ten stocks were selected at random for final and detailed analysis. If such random selection was resorted first (that is from the collection of 3400 stocks), there would be the possibility for selecting stocks which did not have (1) continuity of trading and (2) reasonable volume which are pre-conditions and a base for technical forecasting. To avoid such a risk deliberate

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[7] Magee, John and Edwards, Robert D, 'Technical Analysis of Stock Trends', John Magee, Boston, Massachusetts, the USA.

sampling was resorted first and after ensuring these attributes in the data, random selection is made. Even the name of the company should not affect the decision of a pure technical trader. So the name of the company is taken only for the purpose of identification of data and wherever possible the names are ignored. Instead of names, serial numbers are used in some sections of analysis. The ten stocks selected are listed below:

1. Associated Cement Companies Limited

2. Bajaj Automobiles Limited

3. Century Textiles and Industries Limited

4. Escorts India Limited

5. Great Eastern Shipping Company Limited

6. Glaxo India Limited

7. Grasim Industries limited

8. Hindustan Liver Limited

9. Indian Tobacco Company Limited

10. VIP industries Limited

While selecting these ten stocks, no evaluation is made about any of their fundamental factors or whether they represent the Indian economy because such considerations are beyond the purview of technical analysis, which is built exclusively on trading statistics.

Effect of bonus, rights issues, split, etc.

The market prices were adjusted for bonus, rights issues and also for split, if any. This study does not take them again as it would amount to duplication. So the price on any day is net of adjustment for bonus and rights and splits. The same price

series is used for calculating the terminal value of investments to calculate return and wealth.

Methods of Analysis of Data

Patterns of the same category are constructed with the same rules or conventions of their construction. But some patterns still fail. This leads to another question: whether there is any hidden price behaviour inside every pattern that indicates its success or failure. It requires finding type of dissimilarities in the behaviour of prices 'within patterns' that lead to their success or failure.

To identify traditional patterns, stock charts of the data are drawn by the researcher, using Metastock[8]. The numerical analysis is resorted for testing the validity of patterns and for the entire analysis of technical indicators.

Analysis of patterns

Stock charts are prepared to identify patterns. Daily Bar charting method is used for the analysis of data. Open-High-Low-Close charts are used for the analysis of patterns. These charts also plot the daily volume below the corresponding price bar. The pattern analysis involved the following steps.

(i) Construction of Patterns

The pattern study covers the five major traditional patterns such as (1) Symmetrical triangles, (2) Rising Wedge, (3) Falling Wedge, (4) Head and Shoulders Top and (5) Head and Shoulders Bottom. Factors common to all the patterns are mentioned below while the rest regarding their construction and analysis are mentioned in Chapters Three and Four, where the detailed discussion on them is made.

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[8] Software for technical analysis of stocks, Equiz International, the USA.

In the construction of patterns, significant top points (highest price reached before a downward reversal) are connected to form upper boundaries. Significant bottom points (lowest price reached before an upward reversals) are connected to form lower boundaries. Tops and bottoms are taken to be significant only if they occur on reversals. Three conventions are strictly followed while forming boundaries. The first is that a bottom and a top are never connected to form any boundary. That is 'no boundary is formed by connecting a bottom and a top or a top and a bottom'. Secondly, tops and bottoms are recognized and taken in to consideration only if they are formed at reversal movements. So single period exceptional movements in the direction same as that of the previous prices are not recognized as a reversal point (top or bottom). Thirdly, if a single period (say, a day's) price range forms both the highest price (top) and lowest price (bottom), either of them may be used to form a boundary. Both of them are never used to form both the upper and lower boundaries simultaneously. If highest prices for a few consecutive days are same at which a top is formed, the upper boundaries connecting such a top are formed in the following way: (a) the first period's top is taken as significant for forming up slanting upper boundaries. (b) the last period's top is taken as significant to form down slanting upper boundaries. Conversely, if lowest prices for a few consecutive days are same at which a bottom is formed, the lower boundaries are formed in the following ways: (a) the last period's bottom is taken as significant for forming up slanting lower boundaries, (c) the first period's bottom is taken as significant to form down slanting lower boundaries. This is done to avoid crossbars of prices across boundaries. Only connecting either two or more tops or two or more bottoms form a boundary line. If price congestion occurs at breakout and if more than two price bars cross the boundary, such pattern and breakout there from are ignored and their signal is not taken as a valid signal if closing prices are within the pattern. However, two bars are allowed as the first one is expected at every breakout and the second one is for the purpose of confirming the congestion. Congestion in a stock chart means the area representing the trading history of a stock during a period of time when the price drifts with no identifiable trend. That is, price

movements for a period confine to a very narrow range, usually in a rectangular shape. The other details as to the construction of boundaries are given in the fourth Chapter.

(ii) Recognition of Patterns

A pattern is said to be complete if the traditional conventions of its construction are adhered. The rules for the construction of different patterns are explained under their respective heads in the Third Chapter. This was needed as the rules for the construction of patterns are different for different types of patterns.

(iii) Recognition of Signals

The breakout of prices from boundaries or neckline is recognized as the signal to action-buy or sell. If they are broken up from down, the price is expected to rise and hence is a signal to buy. If they are broken down from up, it is foreseeing a fall and hence is a signal to sell. Breaking of upper boundary of a Rising Wedge pattern or breaking of lower boundary of a Falling Wedge pattern is not considered as a valid signal to act upon. So also breakout with congestion is also invalid.

(iv) Classification of Successful and Unsuccessful (Failed) Patterns

The pattern analysis involves an assessment of the achievement of traditional price objective by each pattern. This is used to gauge how far each individual pattern is successful in the prediction process in the traditional view. The success is revealed by the direction and extent of price change after the breakout (signal for action) from each pattern. Here, it is the extent of achievement of price objective of each pattern that decides its success or failure (traditional predictive capacity). The setting of, and measurement of achievement of, the price objective are done under respective heads of different patterns as they differ with each category of patterns. Price objective

19

means the extent of 'post-pattern price behaviour' as objected or expected traditionally for each pattern. It is the result of this part of analysis that judges whether traditional holding regarding the applicability of technical analysis is valid in the Indian stock market.

If a pattern gave a valid signal of its post-pattern price behaviour and if price moved as predicted by the pattern, such a pattern is called a successful pattern. A pattern is said to be unsuccessful or failed when the post-pattern price behaviour is in the direction opposite to, or not to the extent predicted and thus not according to the signal given by the pattern. Example, if price breaks down the lower boundary of a symmetrical triangle that signals a sell. But if price rises or congests during the immediate post-signal days, such a symmetrical triangle is a failed pattern. A pattern that achieves hundred percent (full) of its price objective is taken to maintain its traditional validity and hence taken as a successful pattern. Any type of prediction can fail and technical analysis is no exception? So there is risk in acting on signals. The probability of this risk can be understood from the proportion of failed patterns in the total number of 'patterns with valid signals'.

Different patterns have their own peculiarities in their formation and forecasting significance, so the other procedures in the analysis as are applicable to any particular pattern are explained under their respective heads in third and fourth chapters.

(v) Testing the Validity of Patterns

The following statistical tests are used in the study in order to ascertain their statistical significance.

1. Test of significance for proportions of success

The standard error (S.E.) in the proportion of success is obtained by the equation:

[S.E. = SQRT(pq/n]

Where   p = the proportion of success

q = the proportion of failure

n = total number of observations

2. Test of significance for difference between proportions

To confirm the difference in the proportion of successful and failed patterns in different categories (signal wise or trend wise), the test of significance for difference between proportions is used. The S.E. in the difference between proportions is obtained by the following equation

S.E. of difference between proportions = **SQRT ((pq(1/n₁+1/n₂)**

Where,   *p = the pooled estimate of the actual proportion of success in the population (i.e., the proportion of success in the pooled sample)*

q = 1-p

n_1 = Number of observation in the first group

n_2 = Number of observation in the second group

3. Test of significance for difference between means

To confirm the difference between mean achievement of price objective by pattern and the traditional price objective, the test of significance for difference between means is used. The standard error of difference between means is obtained by the following the equation:

S.E. of Means = $SQRT(\sigma_1^2/n_1+\sigma_2^2/n_2))$

Where, σ_1 = standard deviation of the first group

σ_2 = standard deviation of the second group

21

n_1 = Number of observation in the first group

n_2 = Number of observation in the second group

(vi) Analysis of Price behaviour inside patterns

The influence of various factors within a price pattern as they appear in stock charts are summarized through candlestick formations and using correlation co-efficient.

Analysis of technical indicators

Signals are triggered by technical indicators when their value reach a certain limit or when the prices cross over them or when the reverse happens.

(i) Indicators Selected

Five commonly known and widely used technical indicators such as (1) Simple Moving Average (2) Moving Average Convergence Divergence (MACD) Index (3) Relative Strength Index (RSI) (4) Stochastics and (5) Rate Of Change (ROC) Index are examined for ascertaining their superiority and consistency in giving a return better than that from non-signal strategies.

(ii) Simulation process for the calculation of return

To ascertain the return generating capacity, purchases and sales were simulated on signals given by the indicators. The return is calculated by comparing the net proceeds and purchase cost. Commission is charged at half a percentage on both ends but other transaction costs, dividends and taxes are ignored while computing the return. The simulation process involves the following: the stock is purchased or sold on the day following the day of 'buy signal' and 'sell signal'

respectively in case of terminal deals[9]. However, daily deals involve: (1) '*buy in the morning and sell in the evening*' during all the 'buy signal days[10]' and (2) '*sell in the morning and buy in the evening*' during all the 'sell signal days[11]'. Morning deals are assumed to be made at the 'opening price' and evening deals at 'closing price'. If same type signals occur consecutively (for example, buy signal is followed by one or more other buy signals) only the first buy signal is considered and acted upon and all other buy signals (that precede a sell signal) are ignored. In other words, only signals for alternate actions (buy or sell) are acted upon. However if a 'sell signal' appears first when one does not have a position in a stock that is considered only under short positions that will be covered on getting the next buy signal. Thus purchases and sales are simulated strictly according to the signals and also according to the trading strategy followed. There are nine different trading strategy options that are available for a trader in the market. The study has examined the investment performance in all these nine cases[12], which are explained in the Fifth chapter.

(iii) Prices used for calculation of return

The average of the highest and lowest prices of the day of trade is the transaction price for both purchase and sale. It is applied when actions are terminal that is when buy or sell is effected only on the day following the day of signal. That is, for all terminal deals under signal strategies and for 'buy-and –hold' non-signal strategy, average price is used. All daily deals are, however, made at opening prices and closing prices depending on the short or long position assumed. The net capital gain, as a percentage of cost of initial deal (buy or sell), is cumulated on an initial investment of Rs.100. The initial investment therefore grows with positive net return and declines with negative net return. Thus the value of investment of Rs.100 is

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[9] Trade only on the day next following the day of signal and not on any other day.

[10] The day/s following a buy signal till a sell signal appears and includes the day of sell signal.

[11] The day/s following a sell signal till a buy signal appears and includes the day of buy signal.

[12] The tenth option to sell first and then buy back after a long period (indefinite short) is not possible in any of the markets of the world. So it is ignored.

made available at the end of each day during the entire period of analysis indicating the changes in wealth position of the trader using technical signals.

(iv) Evaluating the performance.

The superiority or otherwise of the signal strategies using indicator/s over the non-signal strategies is measured by comparing the returns from these two strategies[13]. The strategy with higher average return is taken as the superior one. If 'signal strategies using technical indicators' outperform 'non-signal strategies[14], the indicators are useful tools for improving investment performance. If the result is opposite, indicator is no longer a tool for better investment success. The point here is whether the return is more when one obeys the signals from technical indicators compared to the return without any such signal use. It is necessary that such higher return should not be a casual one, rather it should also be consistent.

(V) Evaluating consistency of performance -Experimental Period and Testing Period

For the purpose of testing the consistency of the superior return generating capacity of technical indicators, the data for the period of fourteen years is divided into two. First half of the period (initial seven years beginning with first January 1990) is the experimental period and the second half (next seven years from first January 1997) is the testing period.

The consistency of superiority of return in either of the strategies is ascertained by the following statistical test. The test is to confirm whether the difference between 'mean return from signal strategies using technical indicator' and the 'mean return from non-signal strategies' is significant not. It is revealed by the *Test of significance for difference between means.*

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[13] Various signal and non-strategies are explained in the fifth chapter.

[14] Non-signal strategy means trading without any analysis or evaluative study of the stock

24

The standard error of difference between means is obtained by the following equation:

S.E. of Means = SQRT($\sigma_1^2/n_1 + \sigma_2^2/n_2$))

Where, σ_1 = Standard deviation of the first group

σ_2 = Standard deviation of the second group

n_1 = Number of observation in the first group

n_2 = Number of observation in the second group

If the result is consistent (whether superior or inferior) the difference between the mean returns during the experimental period and the testing period will not be significant. If the signal strategy is superior during both 'testing period' and the 'experimental period' and the statistical test does not find any significant difference between results in these two periods, then the technical indicators are reliable trading tools facilitating consistent superior investment performance. In any other case, a technical indicator shall no longer be a reliable trading tool facilitating superior investment performance.

Limitations

One patent limitation of this study is that it does not take into account the data on Kerb transactions and those in the Third markets which also may have some influence on the prices and volume of business that is transacted during official hours (Fourth market deals are reported to the exchange). It is the non-availability of such data that necessitated their exclusion from the study. The study did not take into account transaction costs other than commission and also ignored dividend, as the primary aim is to study dependencies of past and future prices.

Scheme Of The Study

The study is designed and presented in the following way:

- CHAPTER 1 INTRODUCTION - This chapter covers introduction to research premises and the idea of technical analysis, relevance of technical analysis in Indian stock market problem, objectives, importance of the study, hypothesis, methodology, sample design, methods of data analysis-patterns and indicators, statistical tests applied, limitations and scheme of the study report.

- CHAPTER II APPROACHES TO SECURITY ANALYSIS- This chapter briefly explains the different analytical approaches-Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis. It also describes relevant findings from various researches and studies to date, on the stock price behaviour in India and outside.

- CHAPTER III TOOLS OF TECHNICAL ANALYSIS- MEANING AND SIGNIFICANCE- This chapter explains different patterns, other tools of technical analysis including indicators and their significance.

- CHAPTER IV: ANALYSIS OF PATTERNS - This chapter deals with the analysis process and results of the patterns. It consist of a general section common to all patterns and five other separate sections dealing with the five patterns analysed in this study.

- CHAPTER V: ANALYSIS OF TECHNICAL INDICATORS - This chapter explains the analysis of selected technical indicators and their uses in confirming technical prediction. They include (1) Moving Averages, (2) Moving Average Convergence Divergence Index (MACD), (3) Relative Strength Index (RSI), (4) Stochastic and (5) Rate of Change (ROC). It also narrates the techniques of data analysis for indicators.

- CHAPTER VI: FINDINGS AND CONCLUSIONS

CHAPTER II

APPROACHES TO SECURITY

ANALYSIS

CHAPTER II

APPROACHES TO SECURITY ANALYSIS

The studies and experiences to date have resulted in the emergence of three different well-known schools of thought on stock market analysis explaining the behaviour of stock prices. They are: (1) Fundamental Analysis [FA], (2) Technical Analysis [TA] and (3) Efficient Market Hypothesis [EMH]. Of these, the first two, though different in their approaches, hold that stock prices are predictable and more return can be made through analysis, while the third has a contrary view.

There is also a new development regarding price behaviour termed as 'Chaotic Behaviour', which says that determinants of 'asset prices' are so complex as to feel a chaotic system and their complexity makes prediction difficult but not impossible. There is no much theory on this to date and hence it has limited currency among the participants in the market. It is a newly emerging view and finds its rarity, whatever it is, only with academicians. So this view is not considered further in the present study.

Fundamental Analysis and Technical Analysis are the two widely known analytical approaches claiming the efficacy of security evaluation. The former is concerned with the analysis of the factors that affect the real worth of the shares while the latter is the study of the trading history of the share or shares.

The fundamental analysis refers to the evaluation of the fundamental factors to determine the real worth (intrinsic value) of a share. These factors relate to the economy, the industry and the company to which the share belongs. The basic tenet in FA is that the share price behaviour is always determined by the changes in the intrinsic value (real worth) of the share and the investment success lies in the ability to predict the intrinsic value and the market price there from.

28

Technical analysis, on the other hand hold that history tends to repeat in the market and as such market itself forecast the prices. Therefore, successful investment is possible by the analysis of the trading history of stocks. The basic assumption is that all the market phenomena are recurring in nature and each such phenomenon is followed by the movement of prices in a particular direction. "No account is taken of the fundamental values because it is assumed that investors expectations concerning those values (and a lot more information besides) are already reflected in prices. This implies that financial market will, infact, always be trying to anticipate the future, and that therefore, changes in financial market prices precede changes in fundamental conditions..............". Hence, "it should be possible to use price behaviour to forecast fundamentals rather than the way sound."[15] Technician, from the pictured trading history of the stock, forecasts when the movement of prices in a particular direction begins or reverses. As such it signals the time for buying and selling stocks.

Definition

Technical analysis may be defined as the examination specialised in the trading history of a certain share or asset or group of shares or assets for the purpose of foretelling the price behaviour thereafter. It is specialised in the sense that it studies only the trading information internal to the stock exchange and no external information, irrespective of the degree of its influence in the share market, is considered at all.

Basic Tenets of Technical analysis

The following are the basic assumptions on which technical analysis built.

i.   Market prices are always determined by the interaction of the demand and supply forces.

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[15] Plummer, Tony, Forecasting Financial Markets-the Truth Behind Technical Analysis, Kogan Page Ltd., London, (1989), P.40.

29

ii.   Besides fundamentals, demand and supply are influenced by numerous other factors such as the fear, guesses, mood, opinion, requirements and the rational and irrational behaviour of thousands of investors.

iii.   Barring minor deviations, share prices tend to move in fairly persistent trends.

iv.   Only shifts in demand and supply balances bring about changes in trends.

v.   Irrespective of why they occur, shifts in demand and supply balances can be detected by examining the implication of each specific market action.

The users of fundamental analysis and technical analysis include investors, brokers, portfolio managers, financial institutions etc. Many of them use either of these methods while others use both. However, the preponderance of the importance of technical analysis over that of fundamental analysis in the following grounds calls our attention: (1) The fundamental analysis does not indicate the time for action, that is, when to buy, sell or hold but technical analysis signs action by detecting turning points in price movements. (2) The cumbersome calculations in fundamental analysis to ascertain the true intrinsic values of stocks are not affordable to the ordinary investors or to all those who are interested in the stock market. (3) There are a lot of factors (like fear) which defy analysis and as such not at all quantifiable but even these are covered and digested by the market action which the technical analyst considers. (4) As fundamental analysts use information from published accounting results also, manipulations in these accounts (window dressing or secret reserve[16]) still creep into analysis also, but technical analysis is fully devoid of such things. (5) All predictions, irrespective of the approach applied, need not be realized as a whole but variations shall have justifiable reasons. There are occasions when deviations of market from the values as calculated by fundamental analysts have gone in an unjustifiable way but which were within the grip of technical analysis as it uses market statistics. (6) Fundamental analysis recognises information which may or may not be backed by action but

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[16] Manipulation of accounts for presenting a rosier or worse than actual condition.

technical analysis recognise market action which covers not only these but something more also which influence action. E.g. A favourable or unfavourable information need not assure an action just because of various other influencing factors like fear, etc. that dominate their decisions.

As speculation increases and irrationalities dominate investor behaviour, share prices drift away from its intrinsic values. Market begins to function on 'hit or miss' basis without any evaluation process. It is especially true in Indian stock market. There does not exist any method to take them into account other than the market analysis. As technical analyst considers none of the causes for the changes in prices, it is in terms of the effects (resulting prices) that he considers the irrationalities, too, which is otherwise un-quantifiable. He does not separate it from any other cause. The combined effect of all the causes are assumed to have been perfectly reflected in the single figure-the price-which he uses for the analysis. Therefore, market statistics cover the effects of all irrationalities also. Extreme levels in the market usually reflect increased irrationalities. It is here the investor has to be more cautious. Technical analysis hedges the irrationalities as it is mechanical in the sense that the investor is required to wait for technical signals before any action and act only on signals. Thus, it is the technical analysis that ensure more rational commitment.

Even the practitioners do not opine that technical tools, despite its elevated position, are foolproof. It rather indicates more realities than what the other would. Again, it does not mean technical tools are to supplant fundamental values, but, more practically, support that its use will do better than what a pure fundamental analysis would provide. There are only very few works to establish the scientific and mechanical way for a more rational trading by using this, so claimed, superior tool. For example, one study by Robert A. Levy, on the systematic movement of stock prices in New York

differences in the perceptions of the market participants. The competition would ensure that the difference between market price and the real worth is not too large to be used profitably. As every piece of information enters the market randomly, the price changes will also be so random. Therefore in an efficient market security price are unpredictable. The thought on the unpredictable, unsystematic and random nature of market price movements is known as Random Walk Hypothesis (RWH) and the movement and as random walk movement.

There are academic literatures evidencing that stock market trading rules based solely on the past price series cannot earn profit greater than those generated by a simple buy and hold strategy. The studies by Cootner (1964), Fama (1965), Mandelbrot (1966) and Samuelson (1965) are examples.

Technical analysts, on the other hand have insisted that these evidences do not imply that their methods are invalid and have argued that the dependencies up on which their rules are based are much too subtle to be captured by simple statistical tests such as serial correlation test, run test and filter rules test.[19]

However, later replication of these could not substantiate Levy's conclusion that "The Theory of random Walk has been refuted".[20] In this regard, effort were already made by Alexander (1961) and (1964) and later Fama and Blume (1966) examined the profitability of various trading rules based only on the past price series which purportedly capture the essential characteristics of many technical tools.[21] These

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[19] (i) Levy, Robert A., "An Evaluation of Selected Applications of Stock Market Timing Techniques, Trading Tactics and Trend Analysis," (Unpublished Ph.D Dissertation, the American University), (1966), (review).

(ii) -------------, "Random Walks: Reality or Myth, "Financial Analysts Journal, (Nov-Dec 1967).

(iii)------------, "The Principle of Portfolio Upgrading," The Industrial Management Review (Fall-1967), PP. 82-86.

[20] Jensen, Micheal C., Bennington, George A., "Random Walks and Technical Theories: Some Additional Evidence." Journal of Finance, (May 1970).

[21] (i) Alexander, Sidney S., "Price Movements in Speculative Markets: Trends or Random Walks .", Industrial Management Review, (1961).

(ii) Alexander, Sidney S., "Price Movements in Speculative Markets: Trends or Random Walks No.2", Industrial Management Review, (1964).

studies also revealed that filter rules do not yield profits (net of transaction cost) which is higher than that of a buy and hold strategy.

Thus the EMH rules out consistent and superior investment performance by the use of any published information whether it be the past price and volume (used by technical analysts) or earnings/dividend changes etc. (used by fundamental analysts).

Efficient Market Hypothesis is concerned with the speed with which information is impounded into security prices and random walk hypothesis is related to how randomly information is generated and the efficiency with which the market digests it. It is not at all concerned with any analytical investment practice, which is a precondition for EMH.

The present practices are quite paradoxical to their statistical results. It is a fact that efficiency follows analysis and cannot precede it and hence when the analysts cease their work, efficiency will disappear.

In short, the theory of EMH does not help the investors in any way to make them more analytical and at least even to make them rational enough to buy, hold or sell shares in the market, in a rather competitive way.

Therefore, it is the practical support, despite the statistical evidence to the contrary, to which more attention ought to be given. Therefore, this study concentrates

(iii) Cootner, Paul H., (ed.) The Random Character of Stock.Market Prices, (Camb6ridge, Mass, MIT   Press 1964).

(iv) Fama, Eugene F., "The Behaviour of Stock Market Prices" Journal of Business Vol. XXXVII, (January 1965).

(v) ---------------------, "Risk Return and Equilibrium: Some Clarifying Comments", Journal of Finance (March 1968).

(vi) Fama, Eugene F., Blume Marshall, "Filter Rules and Stock Market Trading," Journal of Business Vol. XXXIX (January 1966).

(vii) Mandlebrot, Benoit, "Forecasts of Future Prices, Unbiased Markets and Martingale Models," Journal of Business Vol. XXXIX, Part 2 (January 1966).

(viii) Roll, Richard, (Review) "The Efficient Market Model Applied to US Treasury Bill Rates." (Unpublished Ph.D dissertation), University of Chicago, (1968).

(ix) Samuelson, Paul A., "Proof that Properly Anticipated Prices Fluctuate Randomly," Industrial Management Review Vol.6 (Spring, 1965).

on ascertaining the efficacy of analytical forecasts of share prices. Besides this, one essential prerequisite of an efficient market is the presence of sufficiently large number of rational investors. One can be rational only when he is analytical. Also efficient market does not mean that the optimum strategy is to select securities randomly without judgement on information and without detailed analysis of the security. In fact, if a security is efficient, it means that the security analysts are doing their role extremely well. Efficient market hypothesis assumes their great role in the evaluation of securities. Therefore analytical research has its relevance in any market.

Review Of Studies On Price Behaviour In Indian and other Stock Markets

The following are the major works on the share price behaviour in Indian stock market:

Desai (1965) concluded that the dividend per share is the most significant variable which influenced the share prices in the positive direction while the influence of earning per share and retained earnings on share price was weak[22].

Sharma and Kennedy (1977), after applying run tests and spectral analysis to monthly indices of BSE, NYSE and LSE, concluded that stocks in BSE obey Random Walk and are equivalent in this sense to the behaviour of stock prices of developed countries[23].

Chandra (1977) also supported the positive and significant influence of dividend and size of the firm on share prices. The study also revealed that the growth of the firm had a positive but a weak influence on share prices while risk and leverage had no influence on share prices[24].

[22] Desai, Meghnath 'Stock Prices, Earnings and Divdends in India – A Quantitative Analysis' *Indian Economic Journal,.* 12, (1965).
[23] Sharma, J.L. and Kennedy E., "A Comparative Analysis of Stock Price Behaviour on the Bombay, London and New York Stock Exchanges.",Journal of Financial and Quantitative Analysis, (1977).
[24] Prasanna Chandra, 'Valuation of Equity Shares in India', Sultan Chand & Sons, Waryaganj, New Delhi, (1977)

Dixit (1986) found that dividend and earnings were the most significant predictive variables of share prices. Size and book value also were having a positive influence on share prices. The influence of return on investment was weak while leverage and growth were redundant variables of share prices[25].

Rao and Mukharjee (1971) could not find, spectral analysis, any evidence contrary to the random walk. Therefore it is said that behaviour of prices in the Indian stock conform to that in the markets of advanced industrial countries-random walk hypothesis[26].

O P Gupta (1978), who used Runs Test and Serial Correlation analysis, concluded that random walk model appeared to be an appropriate model to describe the share price behaviour in India and which in turn labelled Indian stock market 'weakly efficient'[27].

Yalaguresh (1983) states that CAPM is operative in the greater part of equities traded in India and that the Bombay stock exchange is efficient in the weak form at least in pricing frequently traded stocks[28].

Barua and Reghunathan (1986) study, however, revealed the violation of risk return parity and possibility for generation of return disproportionate to risk, in the Indian stock market. Late, in a response article, they confirmed the inefficiency of the Indian capital market in pricing securities[29].

A survey by Pandey and Bhat (1988) on the attitudes and perceptions of market participants revealed that respondents did not believe that Indian Stock market had been

[25] Dixit. R.K., 'Behaviour Of Share Prices And Investments In India', Deep and Deep Publications, Rajouri Garden, New Delhi, (1986).
[26] Rao, Krishnan N. and Mukherjee, K., "Random Walk Hypothesis: 'An Empirical study", Arthanithi, XIV, (1971)
[27] Gupta. O.P., 'Behaviour of share Prices in India – A Test of Market Efficiency', National Publishing House, New Delhi, (1985).
[28] Yalaguresh, Yalwar B, "Bombay Stock Excahge: Rates of Return and Efficiency.", Journal of Banking and Finance, (1983).
[29] Barua and Raghunathan., 'Inefficiency and Speculation in Indian Capital Markets', Vikalpa, 12, 1986).

efficient in any of the three forms and hence fundamental and technical analysis can be useful[30].

Chaudhuri (1991) could not find, on examining 93 actively traded stocks, serial independence of daily log prices of individual shares. Investors, however unlikely to benefit much from historical prices[31].

The following are the major works on asset price behaviour in various markets abroad:

Alexander (1961, 1964) found that Filter Rules generated a return greater than that from a Buy and Hold rate.[32]

Mandelbrot (1963) pointed out that Alexander's Filter Rule profit calculations were biased and consequently rate was exaggerated[33].

Fama and Blume (1966) also argued that Alexander's result is biased as it did no incorporate dividend and therby, filter rules could not consistently out perform buy and hold strategy.[34]

Van Horne and Parker (1967) found that trading rules based up on moving averages of past prices did not yield profits greater than that of buy and hold policy.[35]

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[30] Pandey,I.M. and Bhat R., "Efficiency Market Hypothesis: Understanding and Acceptance in India", National Seminar of Indian Securities Market: Thrust and Challenges, University of Delhi, (1988).

[31] Chaudhuri, S.K., "Short-run Share Price Behaviour: New Evidence on Weak Form of Market efficiency.", Vikalpa, 16, (1991).

[32] (i) Alexander, Sidney S., "Price Movements in Speculative Markets: Trends or Random Walks .", Industrial Management Review, (1961).

(ii) ----------------------, "Price Movements in Speculative Markets: Trends or Random Walks No.2", Industrial Management Review, (1964).

[33] (i) Mandelbrot, B., "The Variation of Certain Speculative Prices.", Journal of Business, (1963)

(ii) ------------------., "Forecasts of Future Prices, Unbiased Market, and 'Martingale'Models.", Journal of Business, (1966)

[34] Fama, Eugene F., Blume Marshall, "Filter Rules and Stock Market Trading," Journal of Business Vol. XXXIX (January 1966).

[35] Van Horne,J.C., and Parker G.G. C., "The Random-Walk Theory: An Emperical Test.", Financial Analysts Journal, 23, (1967)

Levy (1967) found out the posibility for superior return using relative strength analysis. He refuted random walk hypothesis[36].

Dryden (1969) showed that the conclusions of Fama and Blumes were also biased as they assumed that 'short rate of return' is the negative of the corresponding 'long rate of return' and on removing this bias, more number of Filter Rules could out perform 'buy and hold' strategy.[37]

Stevenson and Bear (1970) found, by examining Corn and Soyabean Futures -1957-1968, that 'stop-loss orders and filter rules combinations' outperformed 'buy and hold' strategy. It means there is scope for profits from technical trading rules while doubting random walk hypothesis.[38]

Jensen and Bennington (1970), by examining Relative Strength Rules of Levy to 29 portfolios of 200 stocks from NYSE, found that these rules did not perform better than the buy and hold policy, net of transaction cost and also when adjusted to risk[39]

Sweeney (1986) found that CAPM can not explain price behaviour in foreign exchange market as there were significant excess returns (risk adjusted) from Filter Rules and major currency markets of the world indicated serious signs of inefficiency.[40]

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[36] (i) Levy, Robert A., "An Evaluation of Selected Applications of Stock Market Timing Techniques, Trading Tactics and Trend Analysis," (Ph.D Dissertation, the American University), (1966).
(ii) --------, "Random Walks: Reality or Myth, "Financial Analysts Journal, 23, (1967).
(iii) --------, "The Principle of Portfolio Upgrading," The Industrial Management Review , (1967)
(iv) --------, "The Predictive Significance of Five Point Chart Patterns.", Journal of Business, 44, (1971).
(v) --------, "Relative Strength as a Criterian For Investment Selection.", Journal of Finance,22, (1967)
[37] Dryden, M., "A source of Bias in Filter Tests of Share Prices.", Journal of Business, 42, (1969)
[38] Stevenson, R.A. and Bear, R.M., "Commudity Futures: Trends or Random Walks?", Journal of Finance, 25, (1970).
[39] Jensen, Micheal C., Bennington, George A., "Random Walks and Technical Theories: Some Additional Evidence." Journal of Finance, (May 1970).
[40] 1. Sweeny, R.J., "Beating the Foreign Exchange Market.", Journal of Finance, 41, (1986).
  2. Sweeny, R.J., "Some New Filter Rule Tests: Methods and Results.", Journal of Financial and Quantitative Analysis, 23, (1988).

Murphy, J. Austin (1986) could not find any statistically significant evidence to support the idea that technical funds (*based on the performance of sixteen purely technical futures funds during the period from May 1980 to April 1985*) can outperform a benchmark buy-and-hold strategy.[41]

Brush (1986), who used Technical Trading system based on Relative Strength to 420 of the S&P 500, found an annual excess return of more than 5% over the equal-weighted S&P 500 benchmark, after transaction costs[42].

Eng. William F. (1988) examined fifteen trading systems and reports on their effectiveness in various types of market environments.[43]

Lukac, Brorsen and Irwin (1988) found that four of the twelve technical trading system simulations resulted in statistically significant net returns higher than that from 'buy and hold' policy after adjusting for transaction cost[44].

Lukac and Brorsen (1990) again such superiority of technical trading systems which were similar across different optimisation strategies and even different parameters concluding little value on parameter optimisation[45].

Jagadeesh (1990) found predictable stock price patterns when looking at monthly returns during the 1934-1987 time period. He found evidence that stocks that experience large increases or decreases in price during one month are likely to reverse significantly during the following month[46]. This type of pattern suggests that investors can profit from technical trading strategies.

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[41] Murphy, J. Austin, "Futures Fund Performance: A Test of the Effectiveness of Technical Analysis," *Journal of Futures Markets*, (Summer 1986).

[42] Brush, J.S., "Eight Relative Strength Models Compared.", Journal of Portfolio Management, (1986)

[43] Eng. William F., *The Technical Analysis of Stocks, Options Futures*, Irwin, (1988)

[44] Lukac, L.P., Brorsen,B.W. and Irwin, S.H.,"A Test of Futures Market Disequilibrium Using Twelve Different Technical Trading Systems.", Applied Economics, (1988).

[45] Lukac, L.P.and Brorsen, B.W.,"A Comprehensive Test of Futures Market Disequilibrium.", Financial Review, (1990).

[46] Jagadeesh, Narasimhan, "Evidence of predictable Behaviour of Security Returns, *"Journal of Finance*, (July 1990).

Sweeney and Surajaras (1989) found that most trading systems generated risk-adjusted mean net-profits after transaction cost. Single moving average rule performed best[47].

Blume, Easley, and O'Hara (1994) showed that traders who use information contained in market statistics do better than traders who do not[48].

Pruitt, Stephen W., and Richard E. White (1998) found that the CRISMA[49]trading system results in profits greater than would be attributed to chance.[50]

Bauer and Dahlquist (1999), by examining several technical indicators for a long period, concludes: (1) signals from technical indicators perform worse than 'buy and hold policy, (2) technical indicators are conservative and hence signal high proportion of cash positions, (3) they outperform 'buy and hold' for stocks that are declining and underperform for stocks that are rising in price, (4) they contain information that may be be of value in trading, (5) results vary with indicator, stock and period, (6) long-short combination is better than either of them and (7) combined indicators results in better signals, though less frequent.[51]

Allen and Kkarjalainen (1999), by applying genetic programming approach to S&P 500 Index for the period from 1928 to 1995, found that technical trading rules could not generate a return greater than that from a simple 'buy and hold' policy, after adjusting for transaction cost[52].

[47] Sweeney, R.J. and Surajaras, P, "The Stability of Speculative Profits in the Foreign Exchanges.", A Reappraisal of of the Efficiency of Financial Markets, (ed.), R.M.C. Guimaaes and others, Heidelberg: Springer-Verlag (1989)

[48] Blume, Lawrence Easley, David and O'Hara, Maureen. "Market Statistics and Technical Analysis: The Role of Volume", Journal of Finance, (Mar., 1994).

[49] CRISMA is a multiple indicator trading strategy using and stands for Cumulative volume, Relative Strength and Moving Average.

[50] Pruitt, Stephen W., and Richard E. White, "The CRISMA Trading System: Who says Technical Analysis Can't Beat the Market?" Journal of Portfolio Management, (Spring 1998).

[51] Bauer Jr. Richard J. and Dahlquist Julie R., Technical Market Indicators: Analysis & Performance, John Wiley & Sons, Inc. New York the USA., (1999).

[52] Allen, F. and Karjalainen R., "Using Genetic Algorithms to Find Technical Trading Rules.", Journal of Financial Economics, 51, (1999).

Teylor (2000)'s study finds that optimised moving average technical trading rules resulting in statistically signifcant positive difference between mean returns for Buy and Sell Positions for the 'Financial Times All Share Index', 'UK 12 Share Index' and for 'most periods of DJIA'. For the DJIA Index, a 2/200 moving average trading rule optimised over 1897-1968 period produced a break-even one way transaction cost of 1.07% during 1968-1988 period[53].

Skouras (2001) found that mean returns from the optimised moving average trading rules were higher than the 'buy and hold mean return only after a transaction cost of 0.06%[54]. It means if transaction cost is above this limit, buy and hold policy is better.

Ready (2002), using fifity genetic programming- based trading Rules and four moving average Rules to DJIA for the period from 1939 to 2000, found that the latter rules poorly performed during 1939-1962 though outperformed during certain periods (1963-1986) and the former rules outperformed later periods from 1987 to 2000[55].

Olson (2004) finds declining trading rule profits over time (profits of moving average rules in foreign exchange markets have declined over time)[56].

As the above results argue for and against market efficiency or security analysis, it may be said that there are mixed views on the efficiency or inefficiency of various markets and profitability of technical analysis -both in India and abroad.

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[53] Teylor, S.J., "Stock Index and Price Dynamics in the UK and the US: New evidence from a Trading Rule and Statistical Analysis", European Journal of Finance, 6, (2000)

[54] Skouras, S., "Financial Returns and Efficiency as Seen by an Artificial Technical Analysts.", Journal of Economic Dynamics & Control, 25, (2001).

[55] Ready, M.J., 'Profits from Technical Trading Rules.", Financial Management, 31, (2003)

[56] Olson, Dennis., "Have Trading Rule Profits in the Currency Markets Declined Over Time?", Journal of Banking and Finance, 28, (January 2004)

CHAPTER – III

TOOLS OF TECHNICAL ANALYSIS-
TYPES, MEANING AND
SIGNIFICANCE

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Introduction

There are several types of tools developed by technical analysts and practitioners in the market. All of them are derivatives of the market statistics on stock-trading. These tools are broadly grouped into 'Traditional Patterns' and 'Indicators'. This Chapter describes the meaning and significance, formation, signal generation, and price objectives of traditional patterns, followed by the meaning, calculation, signal generation of technical indicators.

PATTERNS- meaning and significance

A pattern is a price configuration constructed by connecting certain relevant price points in a stock chart. The relevant price points means a series of bottoms and tops that occur in a sequence. A bottom is the lowest price point formed when falling stock price reverses up. A top is the highest price point formed when a rising stock price reverses down. No tops and bottoms are relevant unless they are formed on such reversals. It is because the net result of a fall is (shown by) the price point (top) where the tendency of the stock price to rise is halted by supply balance. So also the net result of a rise is (shown by) the price point (bottom) where the tendency of the stock price to fall (rise to reverse) is halted by demand balance. The supply or demand balance means the excess of either, over the other. A pattern may resemble any thing in the universe but with certain implications of predictability. In this study only such patterns as have been held as found common in stock charts in other markets abroad are evaluated.

43

The predictive implications of the five patterns that are used in this study are explained in the following sections. The analysis of the patterns and the predictive capacity as revealed by the study are given under their respective heads in chapter-four.

1. Symmetrical Triangle (see Figure 4.1)

Triangles result from narrowing price fluctuations. There must be at least two definite and clear tops and two bottoms (minimum four reversals) to form the upper and lower boundaries of a triangle. The base is assumed to be the vertical line at the first intersection of the price curve (line) and any of the boundaries.

A Symmetrical Triangle (herein after termed as ST) is a triangle-shaped price configuration formed when the prices for some periods move within two converging boundaries. The upper boundary connects two successively lower Tops. The lower boundary connects two successively higher Bottoms. It occurs when each successive rally fails to reach the top of the preceding rally and each successive bottom is higher than the preceding bottom. As the upper boundary connects successively lower tops, it slants downward to right. It must connect at least two minor tops. The First Top (T1) should be above the Second Top (T2). As the lower boundary connects successively higher bottoms, it slants upward to right. It must connect at least two minor bottoms. The First Bottom (B1) should be below the Second Bottom (B2). The point where the two boundaries meet is the apex. Actually there is no third side or boundary to form a real triangle. The Jaw is considered to be the third side (base) of the formation. The symmetry here refers to the approximately equal angle of the boundaries-slope of the lines. That is, a horizontal line, if drawn, at the apex divides it into two equal right angle triangles. During the period of formation of the pattern the prices shall be within the upper and lower boundaries. Converging boundaries implies that the daily 'price fluctuations' are becoming smaller and smaller as the days pass by. Since they are symmetrical, the absolute slope of the boundaries shall be same. The slope of the lower boundary is positive and that of upper boundary is

44

negative with respect to the date scale on 'x' axis. The formation of the two tops and two bottoms completes pattern. After completion, if the price moves out either of the boundaries of the triangle, it is called a breakout. The breaking of the upper boundary means there is demand balance causing a price rise. If the lower boundary is broken, it shows supply balance causing a decline in the price. Thus an upward breakout (breaking of upper boundary) forecasts a further rise in price. A downward breakout (breaking of lower boundary) forecasts a further fall in price. The more the prices move in the direction of forecast, the more the pattern is valid as a predictive tool. The nearer the breakout to apex, the less reliable becomes the breakout because it is easier for successively smaller and less significant moves to break the boundary.

Figure 4. 1 Theoretical Symmetrical Triangle (ST)
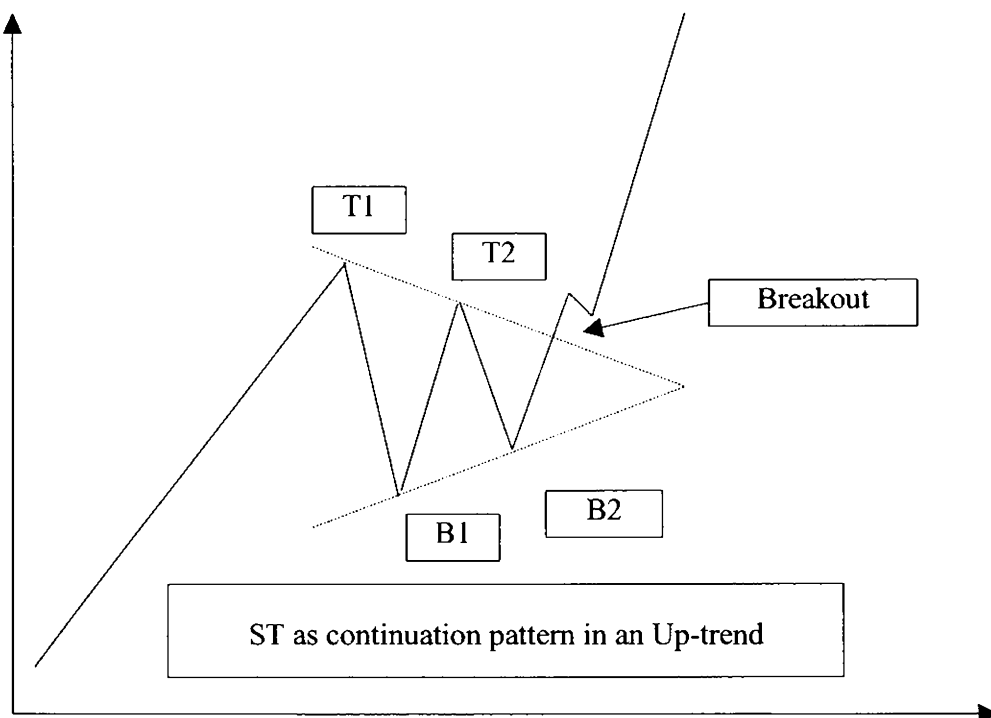
The breakout from a symmetrical triangle is compared to the release of a tightened coil. Hence it is also known as *Coil pattern*. This corresponds to the hesitation of investors for some contingent events to come. The breakout implies their determination either after the contingency is settled or on setting it aside. An upward break out implies that majority opted (perhaps because of good news) to stick to their decisions and even to go longer. A downward break out implies an unfavourable situation where they thin out and even go short. From the beginning of the formation and till it becomes complete, the volume shrinks but increases at breakout. An increase in activity is essential to confirm a valid upward breakout but not necessary for downward break out.

2. Rising Wedge (Figure 4.2)

The pattern called Rising Wedge (RW) is formed from a series of both bottoms and tops formed at successively higher levels and within successively narrowing price ranges. The lower boundary slants upwards as it connects rising bottoms. The upper boundary also slants upwards as it connects rising tops. So the pattern as a whole slants upwards from left to right in the stock chart. The sharper end is upward. As both the boundaries slant upwards, it is remarked Rising and as both the boundaries converge it is named 'Wedge' resembling a natural wedge. Here, each successive rally (T2 is above T1 and T3, if any, is above T2 and so on) goes above the top of the preceding rally and each successive bottom (B2 is above B1 and B3, if any, is above B2 and so on) is higher than the preceding bottom. The upper boundary of the Wedge should connect at least two minor tops and the lower boundary should connect at least two minor bottoms. Thus a Rising Wedge is an up-slanting price formation. The breakout of price from the lower boundary of the pattern forecasts a fall in price. The post-pattern price fall after breakout can also be taken as technical correction of the

previous net rise in price. If the price breaks the upper boundary, it is, however, of no significance and is not a traditionally recognized trading signal.

The breakout of price from a Rising Wedge is compared to the exhausting demand force and dominating supply force. The pattern is formed when there are bids at successively higher rates at which successively smaller supply balance forces the prices to come down and thus forming higher tops.

Since the demand balance is successively larger, deals are struck at higher and higher rates resulting in higher bottoms. In other words, as the days pass by, supply is released only at successively higher prices and initially there is increasing optimism on the part of the buyers to buy at higher and higher prices. By the end of the formation the sellers realise the peak price and thin out and even go short. At this time the initial optimism of the buyers disappears and they reduce their bid rates. Inadequacy of demand to meet the available supply results in sharp fall price. That is why the price goes below the lower boundary. Lower boundary represents a very short term up trend. In other words it is an upward sloping support line. So when it is broken, a reversal of previous movement can be expected. That is why a rising wedge forecasts a fall in price.

Breakout of the lower boundary means excessive supply balance and exhausted demand forcing the price to fall. The breakdown implies an unfavourable situation where the stock does not find a sufficient support. It results in when the demand balances are intentionally and systematically adjusted to the supply for a short time period so as to maintain the up trend. The narrowing fluctuations means less irrationalities and buyers are allured to acquire the stock by maintaining the upward movement. The concerted potential sellers see that demand for the stock is getting reduced as the stock reaches higher price levels when they sell out their holdings at the increased price before the public (majority) does. As no sufficient demand comes to support the fall, the decline becomes abrupt and is crossing the lower boundary line. As it

47

results from a fair decision, the decline is to continue. Thus a rising wedge forecasts a downward movement after the breakout and the formation itself gives a sell signal. In this study the signal to sell is confirmed only at breakout.

3. Falling Wedge (Figure 4.3)

The pattern called Falling wedge (FW) is formed from a series of both bottoms and tops formed at successively lower levels and within successively narrowing price ranges. The lower boundary slants downwards as it connects falling Bottoms. The upper boundary also slants downwards as it connects falling Tops. So the pattern as a whole slants downwards from left to right in the stock chart. The sharper end is downward. As both the boundaries slant downwards, it is remarked falling and as both the boundaries converge it is named 'Wedge' resembling a natural wedge. Here, each successive rally (T2 is below T1 and T3, if any, is below T2 and so on) stops below the top of the preceding rally and each successive bottom (B2 is below B1 and B3, if any, is below B2 and so on) is lower than the preceding bottom.

The upper boundary of the Wedge should connect at least two minor tops-second lower than the first. The lower boundary should connect at least two minor bottoms -second lower than the first. Thus a falling wedge is a down slanting price formation. The breakout of price from the upper boundary of the pattern forecasts a further rise in price. The post-pattern price rise after breakout can also be taken as technical correction of the previous net fall in price.

If the price breaks the lower boundary, it is, however, of no significance and is not a traditionally recognized valid trading signal. So 'sell signals' are ignored.

Figure 4.2 Theoretical Rising Wedge (RW)

Rising Wedge as a reversal pattern
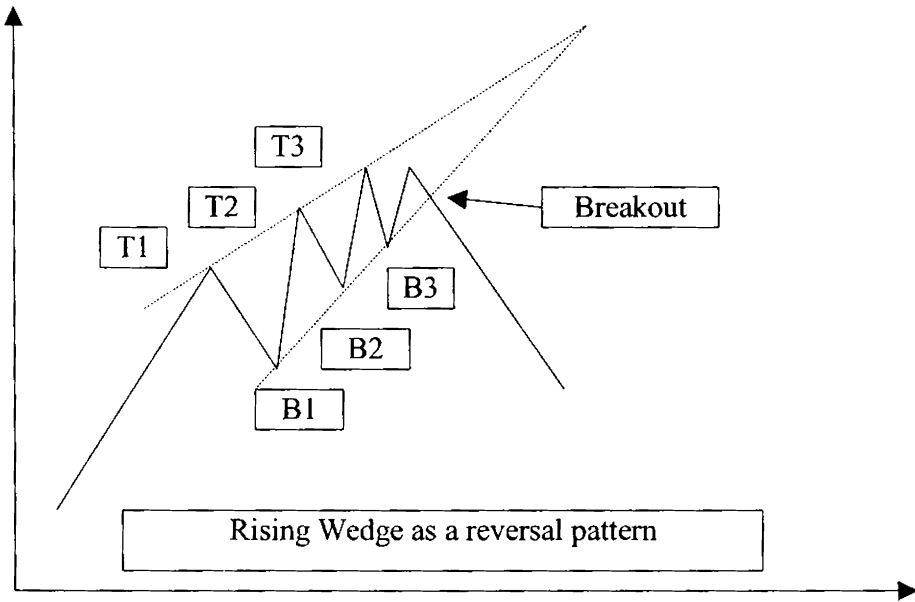
Figure 4. 3 Theoretical Falling Wedge (FW)

Falling Wedge as a continuation pattern
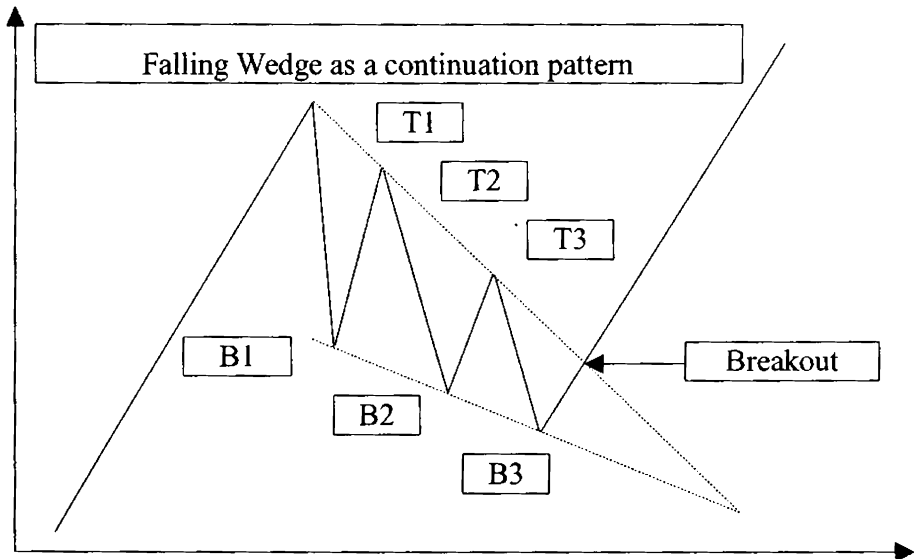
The breakout of price from a falling wedge is compared to the improving demand force and shortage of supply of stock. The pattern is formed when the stock is bought at successively lower rates at which demand balances reverses the prices and thus forming lower bottoms. In other words, as the days pass by, bid is available only at successively lower prices and initially there is increasing pessimism on the part of the sellers and buyers and the deals are struck at lower and lower prices. By the end of the formation the buyers realise bottom price and accumulate. At this time the initial pessimism of sellers disappears and they hold rather than selling out stock and increase their bid rates. Inadequacy of supply to meet the increasing demand results in sharp rise in price. That is why the price goes above the upper boundary. The upper boundary represents a very short term down trend. In other words it is a downward sloping resistance line. So when it is broken, a reversal of the previous downward movement can be expected. That is why a falling wedge forecasts a rise in price. Breakout of the upper boundary means excessive demand balance and exhausted supply causing the price rise. It implies improved optimism where the stock surpasses the resistance areas.

The movement following the breakout from a wedge can be compared to the ejection of a wedge (real) from the pressures where it is applied. Thus longer the wedge (more pressurized), greater is its impact in the expected reversals. The breakout is better confirmed if it is away from the apex.

4. Head And Shoulders Top *(Figure 4.4)*

A Head and shoulders Top (herein after termed as HST) should occur after an extensive rise in price. It is formed of a 'peak' in price surrounded by one lower peak on left side and another lower peak on right side. The tallest peak (in the middle) is called the Head (H). The lower peak on the left side of the head (that is immediately preceding the head) is called Left Shoulder (LS). The lower peak on the right side of the

head (that is succeeding the head) is called the Right Shoulder (RS). There shall be two bottoms between the two shoulders (LS and RS). The first is the bottom formed between the Left Shoulder and the Head. The decline from the 'Left Shoulder' stops at this point and the rally to the 'Head top' begins here. The second is the bottom formed between the Head and the Right Shoulder. It is the point where the decline from the 'Head top' ends and the rally to the 'Right Shoulder' begins. The line drawn connecting these two bottoms is called the Neckline. There fore, the first bottom on the neckline is herein after termed as 'First Point of Neckline' (NL1) and the second bottom is termed as 'Second Point of the Neckline' (NL2). The neckline shall be up slanting or down slanting depending up on the price size at these two bottoms. If the first bottom is lower than the second bottom the neckline shall be an up slanting one. In the reverse case, it shall be down slanting. If the two bottoms are formed at the same price (but on different days), the neckline shall be a horizontal one. As, in technical analysis, a series of lower bottoms implies breaking of previous up trend line, a down slanting neckline shows weakening market sentiment and hence the price can fall more sharply than when the neckline is up slanting or horizontal. During the entire period of formation of HST, the prices shall always be above the neckline. If it breaks the neckline after forming the right shoulder, further fall is forecast. The point where the price cuts the neckline from above is called the 'Breakout Point' (Br.) and the price at this point is called the 'Breakout Price'.

The predictive base of this pattern is that it reflects the following psychological changes of the investor mass. The stocks attract enthusiastic buying which may perhaps be because of good news or the recommendations from various angles. Then volume also rises and the 'rise in price' itself attracts many investors. This causes the rally in the left shoulder. Then a few early birds (may include insiders and those who bought at the beginning of the up trend) smell that 'the time to unload' has arrived and their action (sell) causes a decline and that completes the left shoulder. At this time they do not go short but thin out. A stronger enthusiasm crops up then,

because some think that the prices are relatively low (compared to left shoulder top) and their buying results in the rally to form a higher top (head) when those who were waiting for another rise to divest their holdings, become more determined to get out of their holdings and their supply results in a decline. This completes the head. As they (the informed group) see prices decline (when they have a position), they even buy some stocks to avoid the attention of the public from the declining prices. Thus excess supply is curtailed for the time being. Then there is also another class of investors who buy to compensate for their inaction at the decline stage of the left shoulder. The combined purchases by both these classes though with less enthusiasm make the rally of the right shoulder. At this time 'early birds' not only get out of their holdings but go even short which completes the right shoulder. Then the public also joins the declining trend and stock crosses down through the neckline price level. Oversupply of stocks floods the market and fall becomes abrupt and then becomes gradual.

A head and shoulders top pattern forecasts a further fall from the neckline price point at breakout at least equal to the (vertical) distance from the 'head top' to the neckline. The neckline implies a probable support level for the immediate past declines of prices and crossing which, it is so held, means that the market has lost the entire optimistic sentiment, if any.

5. Head And Shoulders Bottom *(Figure 4.5)*

A Head and shoulders Bottom (herein after termed as HSB) should occur after an extensive decline in price. It is the upside down version of the head and shoulders top, where rallies and declines are mutually replaced. A Head and Shoulders Bottom pattern is an upside down version of a Head Shoulders Top (HST) pattern. So it is also known as 'Inverse Head and Shoulders' pattern. An HSB is formed of a trough in price surrounded by one higher trough on left side and another higher trough on right

side. The deepest trough (in the middle) is called the Head (H). The higher trough on the left side of the head (that is immediately preceding the head) is called Left Shoulder (LS). The higher trough on the right side of the head (that is succeeding the head) is called the Right Shoulder (RS). There shall be two tops between the two shoulders (LS and RS). The first is the top formed between the Left Shoulder and the Head. The rally from the 'Left Shoulder' stops at this point and the decline to the 'Head bottom' begins here. The second is the top formed between the Head and the Right Shoulder. It is the point where the rally from the 'Head bottom' ends and the decline to the 'Right Shoulder' begins. The line drawn connecting these two tops is called the Neckline. There fore, the first top on the neckline is herein after termed as 'First Point of Neckline' (NL1) and the second top is termed as 'Second Point of the Neckline' (NL2). The neckline shall be up slanting or down slanting depending up on the price size at these two tops. If the first top (NL-1) is lower than the second top (NL-2) the neckline shall be an up slanting one. In the reverse case, it shall be down slanting. If the two tops are formed at the same price (but on different days), the neckline shall be a horizontal one.

As, in technical analysis, a series of successively higher tops implies breaking of previous down trend line, an up slanting neckline shows strengthening market sentiment and price can rise more sharply than when the neckline is down slanting or horizontal. However if the neckline is a down slanting one, even smaller price rises shall be enough to break it.

During the entire period of formation of HSB, the prices shall always be below the neckline. If it breaks the neckline, from below, after forming the right shoulder, further rise is forecast. The point where the price cuts the neckline from below is called the 'Breakout Point' (Br.) and the price at this point is called the 'Breakout Price'.

53

Figure 4.4 Theoretical Head and Shoulders Tops (HST)

HEAD
RS
LS
Breakout
Neckline
NLB-1   NLB-2
HST with Horizontal Neckline
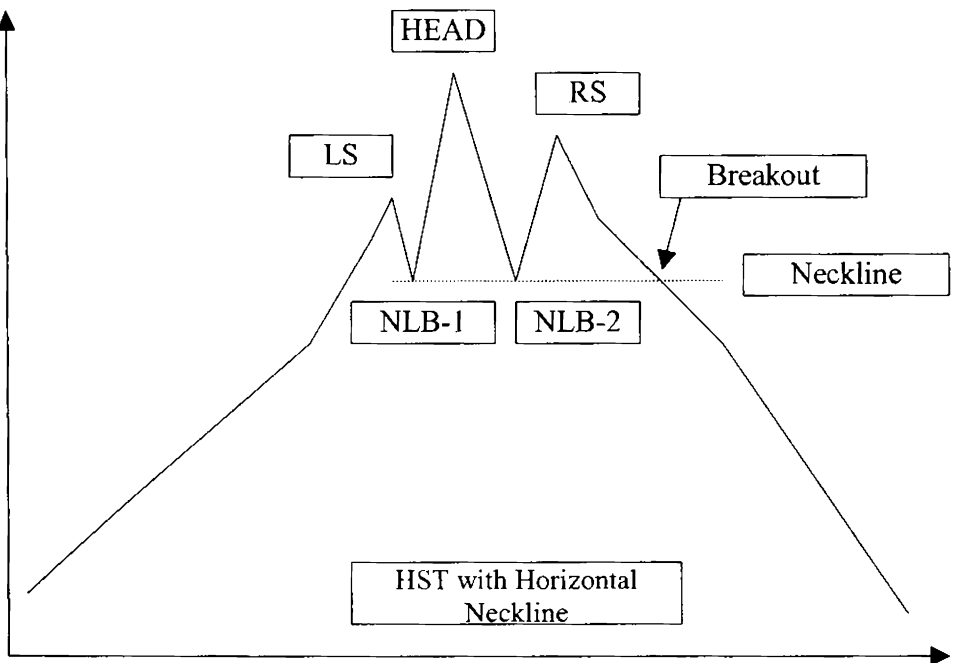
Figure 4.5. Theoretical Head and Shoulders Bottoms (HSB)

HSB with down slanting neckline
NL-1
NL-2
Neckline
Breakout
RS
LS
HEAD
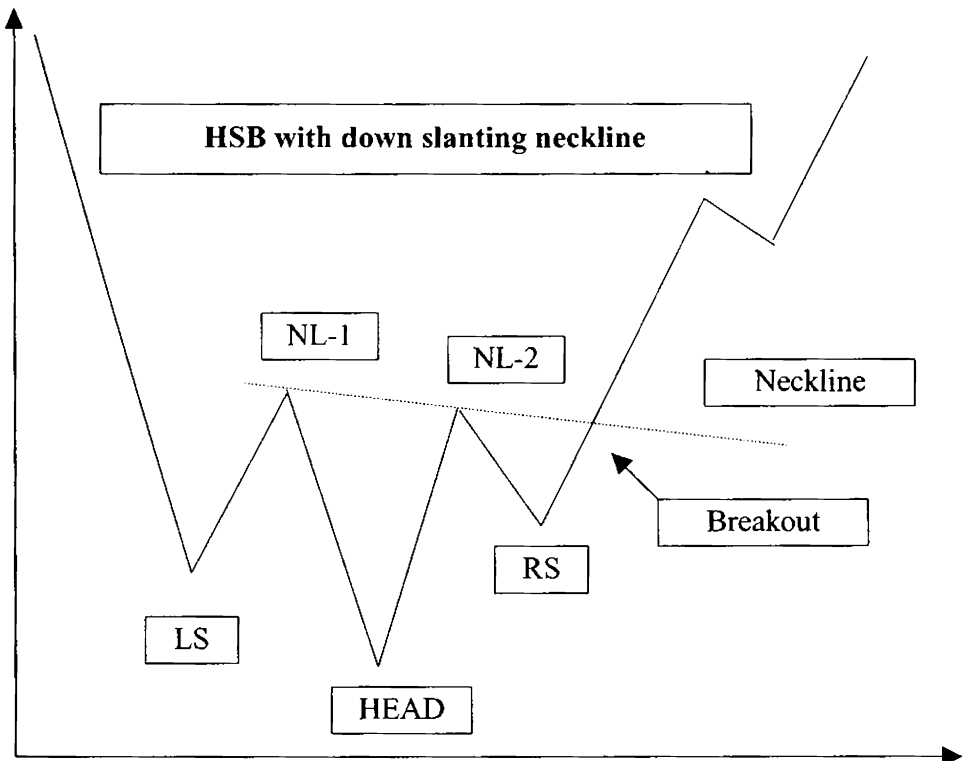
The occurrence of this pattern forecasts an upward movement of prices, at least equal to the price (vertical) range from the bottom point of the head to the neckline.

It is the investor pessimism that makes the extensive downtrend ending at the bottom of the left shoulder. Then some investors realize that the market has come to ground and make a position and the price rises. This completes the left shoulder. As market provides relatively higher prices some investors divest their holdings. Such sale causes further fall climaxing at the bottom of head. Those who smell the market bottom, acquires the available supply and this results in prices to rise from the lowest bottom. This completes the head. The smart money may even sell some of their holdings to distract the attention of the public from the bottom prices in the market. Their sales together with that of others (who could not sell during the rally of left shoulder) constitute the decline of the right shoulder. Such decline is halted by demand force at a price higher than the bottom of head. This results in the right shoulder. The smart money goes long and the stocks gain the attention of the public. Increased purchase orders boost up the prices. Majority of investors become sticky to their holdings and even try to go longer. Higher and higher bids are required to stimulate a sale and this pushes the stock price far up from the neckline.

The essential difference between these two patterns (HST and HSB) lies in their volume trends. In the case of head and shoulders bottom there will be an increasing trend in volume as the pattern completes and substantial volume as the price breaks up the neckline. Hence inadequacy of volume at the breakout from a head shoulders bottom makes it less reliable, for a good activity is required for prices to rise, though not for a fall. That is why it is said that 'price can fall of its own weight'. Light volumes at breakdowns will not affect their validity.

55

TECHNICAL INDICATORS

Technical indicators are numerical derivations from price and volume figures. They are used independently or complimentary to other technical tools such as patterns, trends, support and resistance levels, etc. The most commonly used and widely known five indicators are examined in this study. They are: (1) Moving Average (MA), (2) Moving Average Convergence Divergence Index (MACD), (3) Stochastic, Relative Strength Index (RSI) and Rate of Change (ROC). The meaning, construction (equation) and predictive implications of these five indicators are explained in the following paragraphs.

1 Moving Averages

From the practical point of view of price analysis and prediction, price changes or volatility in the market consists of more significant movements and less significant or insignificant movements. The identification of the underlying trend of the prices is possible without considering the insignificant movements. Trend lines reveal such trends in a straight line and their statistical expression takes a linear relationship[57]. Moving average, as a technical tool, is also an attempt to iron out such insignificant movements and to obtain a smoothed trend curve of the price movement instead of a straight line. Moving average shows the trend in a curvilinear, smoothed or curve shape establishing a curvilinear relationship of price over time[58]. By using a moving average, the distortions in the (main) trend are reduced to minimum. There are different types of moving averages. They may be simple, weighted or exponential and as such their construction, significance and interpretation in the prediction process are also different. The present study uses only simple moving average series. So it is dealt in detail in the following a few paragraphs.

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[57] Expressed as $Y = a + bx$
[58] Expressed as $Y = a + bx^2 + 2c$

Construction Of Simple Moving Average

Simple moving average is the most widely used moving average compared to weighted moving average and exponential moving average. Moving averages are simply a series of averages of consecutive data for a given period. The number of periods' prices taken for calculating the average will remain the same through out the series. It is called 'moving' as every successive average drops the first item in the previous average and takes a new item to it.

The averages shall represent the actual prices ironing out insignificant movements thereon. If the 'number of days' taken is of shorter periods, the effect of ironing or smoothing shall be less and shall reflect even minor moves. If the period is longer, the effect of smoothing will get improved reflecting only the major changes.

There are certain primary things that should be decided in advance and are common for the construction of any type of moving average for stock prices. They are: (1) The number of periods (days, weeks, months, etc) for which average is to be calculated. (2) The price to be used (open, high, low or close or an average of some or all of them and (3) the placing or positioning of the average figure. They influence the signal generating process. Signals become too early or delayed depending on these three factors.

The study examines a short term moving average of fifteen days (15 DMA) and a long term moving average of forty three days (43 DMA). Closing prices are used · for the calculation of both the moving average series. All the moving average values are placed at the middle period. These periods were selected by trial and error method so as to optimise the return[59].

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[59] Same procedure is applied for selecting the respective periods for the other four indicators also.

Valid signals

Signals to buy or sell are generated when moving average changes direction or when the prices cut it. A fall in price is signalled when price moves below its moving average. A price rise is signalled when the price comes above the moving average.

2. Moving Average Convergence Divergence (MACD) Index

As the name implies, Moving Average Convergence Divergence (herein after referred as MACD) Index measures the convergence and divergence between two (exponentially smoothed or simple) moving averages. One of them is a Short-term Moving Average (SMA) and the other a Long-term Moving Average (LMA). The latter is deducted from the former to get the MACD value. Closing prices of the day, week, etc. are used to calculate the moving averages. As the MACD data are the absolute differences between these two moving averages, the index oscillates across zero line which shows that the absolute difference between these two averages is zero. So long as the SMA is greater than the LMA, the MACD line will be in the positive region and it will be in the negative region when the latter is greater than the former. When a stock's MACD which has been in the negative region crosses the zero line and rises further in the positive region it signals a buy. Then the scrip is said to have gained momentum. On the contrary, if it crosses down the zero line from the positive region and falls into the negative region it signals a sell.

Another way of using the MACD Index is to create another moving average (simple or exponential) of the absolute MACD data, for a very short period of, say, seven days or ten days and is super-imposed over the absolute MACD graph. This average line will act as a trigger of the MACD movements so as to signal the buy or sell action. When the MACD (absolute) index crosses down this (MACD average) trigger line, it is a sell

58

signal. If it crosses the trigger line from the downside, (an MACD index rises above the trigger line), it is a buy signal.

Two MACD series are examined in this study. One is a combination of twenty-eight day long term moving average and a twelve-day short term moving average. The other consists of fifty-six day long term moving average and a twelve-day short term moving average.

3. Relative Strength Index (RSI)

The Relative Strength Index (here in after termed as RSI) measures the short-term strength or weakness of the stock. The RSI, a momentum indicator, is calculated by comparing the average of the individual day's gains and the average of the individual day's losses for a short period of time, say, five days or seven days. If a particular day's closing price is greater than the previous day's closing price it is taken to be the gain for that day. Such gains, if any, for all the days during the period selected for calculating RSI is averaged by dividing the total gains by the number of days in the period. So also losses are calculated. If the current day's closing price is less than the previous day's closing price, the difference is taken to be a loss. These losses are also averaged as done in the case of gains. The average of the gains for the period is divided by the average of the losses for the period to get RSI and to know the relative position.

Relative Strength Index (RSI) measures the strength of a stock price to rise relative to its strength to fall or the strength to fall relative to its strength to rise. The former is known as upward momentum and the latter is known as downward momentum. It gauges the strength of the prices to move in a certain direction (fall or rise) during a certain period relative to its strength to move in the other direction (rise or fall).

The formula for calculating RSI is as follows:

$$RSI = 100 - 100 \div (1 + RS)$$

Where, RS is the ratio of positive changes to negative changes and is obtained by the following formula:

RS = the average of positive changes ÷ Average of negative changes

If the sum of positive changes during the period is equal to zero, the RS shall also be zero.

However, if sum of the negative changes is equal to zero, then RS is taken to be the sum of positive changes, that is, the sum of negative changes is taken to be unity. The index fluctuates in a constant range of zero to hundred (0-100).

Peter W. Aan found that the average value of RSI top occurred at 72 and bottom at 32 levels[60]. If RSI is calculated for a longer periods, frequency of signals of overbought or oversold conditions can be reduced. The selection of the period has a bearing on the trend- minor, intermediate or primary- that is to be monitored.

Interpretation of RSI

The study uses the above formula for the calculation of RSI. Signals are generated as its value reaches a certain limit which is different for short term RSI of Six days and Long term RSI of Thirty six days examined. These trigger values are mentioned in the Fourth Chapter.

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[60] Peter W. Aan, Futures, January 1985.

60

4. Stochastics

The base behind the creation of Stochastic is that the prices tend to close at the higher end during uptrend periods and at lower ends during down trend periods. Reversals are indicated when closes happen at the opposite ends. (low side in uptrends and upside in down trends). Stochastics are constructed using high, low and closing prices and two lines made therefrom: '%K line' and '% D line'.

%K is calculated as:

$$\%K = 100(C\text{-}L_N \text{ close}) \div (H_N\text{-}L_N)$$

where

C = the most recent closing price

L_N = the lowest low for the last 'N' trading days.

H_N = the highest high for the last 'N' trading days

% D is a 'n' period smoothed version of the %K line and computed as:

$$\%D = 100 \ (H_n \text{ - } L_n)$$

where

H_n = 'n' period sum of (C-L_N)

L_n = 'n' period sum of (H_N- L_N)

'n' < 'N'

%K is plotted as a solid line and %D is depicted through dashed line.

Stochastics can be computed for longer periods on monthly and weekly data. *Golby and Meyers found out that stochastic indicator tested very poorly relative to moving average crossovers and other momentum indicators*[61].

The study examined two different series of stochastic series. One is a long period stochastic of thirty five days and another one is short period stochastic of twelve days.

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[61] Colby, Robert W. and Mayers Thomas A., The Encyclopedia of Technical Market Indicators, Dow Jones-Irwin, Homewood, Illinois (1988).

5. Rate Of Change (ROC)

Rate of Change (ROC) is another important measure of momentum. It is a relative measure, which expresses the current price of an asset as a percentage of its price in a base period. It measures the speed of change in the price during a particular period as compared to the price on a certain period ('n' periods) back and is expressed as a percentage. If a 'ten days' interval is taken, a day's price may be compared to the price ten days ago. For obtaining a series of ROC values, every subsequent day's price will be expressed to the base price 10 days ago counted from that date. The series so obtained shall oscillate around a central horizontal line called the reference line. This reference line is the equilibrium line. If current and base prices are same (p), ROC shall be equal to 100 (i.e., p/p x 100). If current period's price is higher than the base period's price, the ROC shall be above the reference line and in the reverse case it shall be below the reference line. Thus, ROC as an indicator also reveals whether price moves in either in up trend or down trend, but relative to the price 'n' periods back.

This index measures the speed with which a stock's price falls or rises. It is held that the prices move with clearly different speed at the beginning, continuation, saturation and end of a trend. Rate of change analysis tries to capture the benefits of this holding. It is very common that stock price moves up or down, especially during large and extensive trends, with some speed in the beginning of the movement, then accelerates, then slows and finally reverses. ROC indicator reveals the rate of speed of these movements and warns the investor of the likely reversal resulting from overbought or oversold situations.

The series of ROC values (for charting or other purpose) may be obtained by two different methods. In the first method, the current price is expressed as a percentage of the base price. In the second method, the change in prices (i.e., current price minus base price) is expressed as a percentage of the base price. So the second gives a ratio of

change while the first reveals the ratio of the price itself. The construction of, and signal generation by each method is illustrated below.

(a) ROC when current price is taken as a percentage of base price.

It is a price index number. It is constructed by the following formula.

Current ROC Index = Current Period's Price ÷ Base period's price * 100

If this formula is used the reference line shall be the horizontal line where ROC value is at 100 level (i.e., Y axis =100 level).

(b) ROC when the 'price change' is taken as a percentage of the base price.

The second method is a variant of the first with an adjustment involving deducting 100 from the ROC value obtained by the first formula. In other words it takes the difference between the ROC value computed by the first method and its reference point (100). Here, the change in current price (increase or decrease) over the base period price is expressed as a percentage of the latter. It may be obtained by either of the two following formulae:

1. Current ROC = [(Current Period's Price - Base period's price)/ Base period price *100

2. Current Period' s ROC = [(Current Period's Price/ Base Period's Price)*100]-100

In the second case, the reference line shall be horizontal line at the point where ROC value is at zero level (i.e., horizontal line at Y = 0). It is because the second method simply deducts 100 from each of the ROC values computed by the first method.

The present study uses the second ROC formula.

63

CHAPTER IV

ANALYSIS OF PATTERNS

CHAPTER IV

ANALYSIS OF PATTERNS

As already stated, traditional patterns are price-forecasting tools. The success of a pattern is determined by the extent of the 'post-signal movement' of price, that is, the achievement of its price objective. The present study is an attempt in this regard to confirm whether the same traditional view with respect to patterns holds true in Indian stock market. The study covers only five patterns that are widely known and commonly reported such as (1) Symmetrical Triangles, (2) Rising wedges, (3) Falling Wedges, (4) Head and Shoulders Top and (5) Head and Shoulders Bottom.

The result of the analysis of these five selected patterns is presented in the following five separate sections.

- Section 4.1 Symmetrical Triangles,
- Section 4.2 Rising wedges,
- Section 4.3 Falling Wedges,
- Section 4.4 Head and Shoulders Top and
- Section 4.5 Head and Shoulders Bottom.

In each section, evaluation is made on the following points in respect of the pattern concerned:

1. *Occurrence and frequency of reoccurrence of different patterns in stock charts.* If the patterns do not re-occur, any prediction using them is not possible. A category-wise frequency will also reveal which 'pattern and signal there from' can be more expected than others

2. **The generation of valid signals.** Once a pattern occurs, it is expected to give signal that should be valid for action. In this regard, the study does not take a signal as valid if 'the breakout happens with congestion at boundary or neckline' or when 'the closing price of the breakout day is within the boundary'. They are traditionally not considered to be valid signals for action. Hence patterns giving valid signals only are further examined for ascertaining their predictive capacity in the traditional view.

3. **The frequency of occurrence of each category of pattern in different trends**[62]. This will reveal the influence of the trend during which a pattern occurs has on its frequency, its signal generation capacity and probability of its success in different trends. This is an attempt to capture the trend wise difference in the validity of traditional holding with respect to patterns and also the trend wise superiority, if any, and to know the implications of different trends in the success or failure of each category of patterns.

4. **The general, trend-wise and signal-wise direction and extent of the post-pattern price behaviour.** These would reveal whether price movement after the occurrence of the pattern and signal there from concurs and conforms to the traditional view. The trend-wise analysis will reveal the influence of trend during which patterns occur on their predictability. The signal-wise analysis will reveal the superiority of either of the signals over the other in the predictability as revealed by the success or failure. Of the five patterns studied, only Symmetrical Triangle pattern can give either of the signals (buy or sell) after its formation where as the other four can give only one type of signal at any time. So signal-wise analysis is made only for Symmetrical Triangle pattern.

5. **The probability or proportion of successful patterns.** It shows how far reliable a pattern is as a price prediction tool. The statistical test (mentioned in

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[62] *Trend means the long term general movement of prices in either direction- up or down. The Up trend and down trend periods were identified in this study by examining the concerned stock charts.*

methodology) would establish whether predictability of traditional patterns still holds true in Indian stock market.

6. **The extreme behaviour of price after breakout.** This is to examine the extreme extent of success or failure resulting from actions based on signals triggered by the patterns. It is also to guard off the 'usually possible average result' being challenged and questioned by stray and casual claims of success or failure.

7. **Time lag up to reversal day/s.** This is to ascertain the duration taken by the patterns to achieve their traditional price objective after signals. It answers how many days it takes for achieving the price objective from the day of signal to the respective reversal days. Longer the period the less is the value of benefits received, when adjusted to time, while signals are acted upon. In other words, it implies holding period of 'in the market position' of an investor relying on patterns.

8. **Significance of volume inside a pattern.** Volume refers to the total number of shares traded on a day for a given price range. All price rallies, though not all the declines, are expected to accompany good volume. Volume is considered to be relevant also in confirming signals, especially 'buy signals'. The result in this respect would reveal the volume-dependence in the confirmation of signals. For volume analysis the data are streamlined by averaging and converting in to relative values so as to iron out extremities and also to avoid drawbacks of considering a single day's absolute volume. It was done in the following way. Based on the size, the relative volumes were classified in to three groups such as 'Below Normal', 'Normal' and 'Above Normal'. For getting the relative volume, the actual absolute volume figure for each relevant day is divided by a ten-days moving average volume corresponding to that day and thus obtained a relative (quotient) volume figure for that relevant day. If this quotient is 'less than one' for any of the relevant day, it is taken as 'below normal volume'. If the quotient is 'one or more than one, but less than two', it is taken as 'normal volume'. If it is 'two or greater

67

than two', it is taken as 'above normal volume'[63]. (Ten periods average corresponds to two week's volume as there are only five trading days in a week.).

9. ***Significance of price behaviour inside a pattern.*** The price behaviour inside a pattern is analysed by using, and with the help of, candle formations inside a pattern. Candles reflect demand and supply balances. They are taken to represent 'the price movements inside the pattern'. The **shade** and **shape** of candles are used to judge the excesses in the intra-day demand and supply forces and their significance in the success or failure of the patterns. The two shades of candles are white and black showing different demand supply balances. The two shades show that the demand and supply balance were different in the opening and closing hours of a trading day where as the three shapes show that the demand and supply balances were same in these hours. **White candles** show demand balance while **black candles** show supply balance. Three different shapes used are, (1) *Dojis (+ type)*, (2) *'T' type Doji lines* and (3) *Inverted T type Doji lines ('⊥').* A doji shows this equilibrium some where in the middle of the intra-day extreme movements of prices. '*T*' type Doji lines show survival of demand balance at the closing hours as it was at the opening time despite intra day price fall (open and close are at the highest price of the day). Doji line like '⊥' (Inverted T type) show supply balance emerging at the closing hours despite intra day price rise (open and close are at the lowest price of the day).

These five different (non-overlapping) candles (two candles of different shades and three candles of different shapes) were examined to ascertain whether there is any relationship between the preponderance in the frequency of their occurrence and the achievement of price objective.

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[63] During buoyancy, normal volume in the neighbourhood days increases in a pyramidal shape and hence a higher ratio only can pinpoint exceptional increases.

68

The result of analysis of the above points in respect of a pattern, would reveal whether traditional holding with respect to the pattern work in Indian stock market and the possibility for taking traditional patterns as a valid signalling tool.

After signal, no indefinite waiting is allowed for the pattern to achieve its price objective. For achieving the price objective a standard waiting period of three reversal days was followed based on the principles of Elliott's Wave Theory[64]. The standard was to take into account only three consecutive 'tops' or 'bottoms' that immediately followed a breakout (signal). But it is not a fixed time period, rather a preset number of reversals in prices. The post-signal price change up to these standard (fixed) reversal points only is considered for evaluating the success of a pattern. In other words a pattern has to achieve its traditional price objective on before any of these three reversals. Three consecutive 'post-pattern Tops' are considered for buy signals and three consecutive 'post-pattern Bottoms' are considered for sell signals. The days on which the first, the second and the third reversal points in prices occur are termed as 'First Reversal Day', 'Second Reversal Day' and 'Third Reversal Day' respectively. According to this theory, prices reverses at the end of the fifth impulse wave which is actually the third wave in the forward direction and after which price movement reverses and enters a correction phase.

The conclusions derived from the statistical test results in the next five sections are true only at ninetyfive (95%) percent confidence limit unless otherwise specified. All the probability values in Tables are in percentage terms. Classification of patterns into successful and unsuccessful; and a sub-classification of unsuccessful patterns into four more categories (with percentage achievement levels such as 'less than 25', 'between 25-50', 'between 50-75' and 'between 75-100') is to bring to light that the failure of patterns is in different intensities. It would also open ways for further

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[64] Elliot, Ralph Nelson; Nature's Law-the Secret of the Universe, Elliot, New York, 1946. (Reprint Prechter, Robert R.(ed.) The Major Works of R.N. Elliot, New Classics Library, New York, 1980.)

research so as to find out a revised target of price objective, if any, that suits each traditional pattern.

*Charts are given only to depict those technical aspects and concepts, which would otherwise be less clear. They do not form part of analytical base or results. All the charts given in different sections in this chapter are independent and used only for the purpose of illustrating the various concepts of 'price objective' of different patterns and for depicting the way of their measurement. So they should not be taken as comparable. All the charts are drawn in Meta-Stock by the researcher using the same data taken for analysis. **So the source of data / charts is not mentioned in each case.** To ascertain the preferable **trend** to act upon, the difference in performance of each category of pattern occurred during different trends-up or down- is analysed. Similarly, the preferable **signal** to act upon is ascertained by examining the difference in performances of patterns with different signals-buy or sell. Performance here means the achievement level of price objective by the patterns.*

General summary derivations from pattern analysis

The following general details as to the occurrence of different patterns are obtained from the analysis and they are presented in the Table 4.1. It shows that the most frequent pattern is Falling Wedge while Head and Shoulders Bottom is the least frequent. Eighty three percent (83.23) of the patterns are found giving valid signals while nearly seventeen (16.77) percent of the patterns were found invalid. Signals from valid patterns only can be acted upon. Therefore, only valid patterns are further analysed. Taking the frequency of patterns during the data period and for the stocks analysed, the table supports the view that there is rarity of patterns to trade, using the signals from them. That is fewer patterns (chance to trade) per stock per annum (only 765 patterns for ten stocks for fourteen years).

70

Table 4.1 *General classifications of patterns found based on validity of their signal*

Pattern	Valid		Invalid		Total	
	Number	%	Number	%	Number	%
Symmetrical Triangles	166	18.06	28	3.05	194	21.11
Rising Wedge	218	23.72	44	4.79	262	28.51
Falling Wedge	238	25.89	63	6.86	301	32.75
Head and Shoulders Top	80	8.71	7	0.76	87	9.47
Head and Shoulders Bottom	63	6.85	12	1.31	75	8.16
Grand total	**765**	**83.23**	**154**	**16.77**	**919**	**100**

The next five sections contain the result of further analysis of individual patterns that are found giving valid signals.

SYMMETRICAL TRIANGLE ANALYSIS

The formation of a Symmetrical Triangle Pattern is explained in the fourth chapter. Prices may break either the upper boundary or the lower boundary and hence this pattern may give a buy signal or a sell signal depending on the boundary of the pattern broken by the price. The breakout of upper boundary forecasts a further rise in price and thus gives a buy signal. Breaking of lower boundary forecasts a further fall in price and thus gives a sell signal.

Price Objective of a Symmetrical Triangle

The traditional holding about a symmetrical triangle pattern is that if the price breaks either boundary, then the price should move in the direction of breakout at least to the extent of its Jaw (base) length. Jaw is the vertical distance from the first relevant point (T1 or B1) to the opposite boundary. So the amount equal to the Jaw length of the symmetrical triangle is the traditional price objective of this pattern. The validity of traditional view of predictability of a Symmetrical Triangle pattern is revealed by the extent of achievement of its price objective (P.O.).

Starting Point for measuring the Price Objective

The targeted 'price change' is measured from the boundary opposite to the boundary of breakout, the price should move in the direction of breakout at least up to the line drawn at the first relevant point *(First Bottom in the case of a downside breakout as shown in Chart 4.1) and First Top in the case of an upside breakout as*

shown in *Chart 4.2)* and parallel to the boundary opposite to the boundary of breakout. The study examined whether it so happened.

Occurrence and reoccurrence of the Symmetrical Triangle Pattern

Out of the 765 valid patterns found out from the stock charts of 10 companies analysed, 166 are symmetrical triangles. So patterns called symmetrical triangles occur in the stock charts of companies in Indian stock market.

The following are the results of analysis of the 166 symmetrical triangles.

Probability of successful Symmetrical Triangles

A pattern is taken to be successful if it achieves its traditional price objective in full. The table 4.1.1 shows that only 23.49% of the symmetrical triangles could achieve their price objective in full (100%) on the first reversal day. This was 38.55% and 40.96% for the second and the third reversal days respectively. Successively higher proportion of symmetrical triangles achieving their price objective on the first, second and third reversal days means, and gives a conclusion, that longer holding period (waiting) results in more number of successful symmetrical triangles as measured by the achievement of their price objective in full. (Signals resulting in smaller achievement of price objective will further make the deal unprofitable due to commission and other transaction costs and achievement with longer holding period would make the deal less profitable owing to interest factor.) This, being the observed sample values which is less than the target, the next option is to test the result for ascertaining whether the theoretical proportion of 'successful STs' can ever be hundred percent. In other words, whether there is probability for all the STs to achieve their traditional price objective. If this probability is greater than fifty percent, that means STs are more probable to succeed than to fail in signalling a buy or sell action. The Statistical test of significance for proportion of success [S.E.= Sqrt(pq/n] has been done to ascertain the theoretical limits (based on the observed sample values) with which the STs achieve various levels of price objective.

73

Chart No. 4.1. Price Objective of Symmetrical Triangle with Sell Signal

Source: BSE Data, Chart drawn by the Researcher in Metastock

74
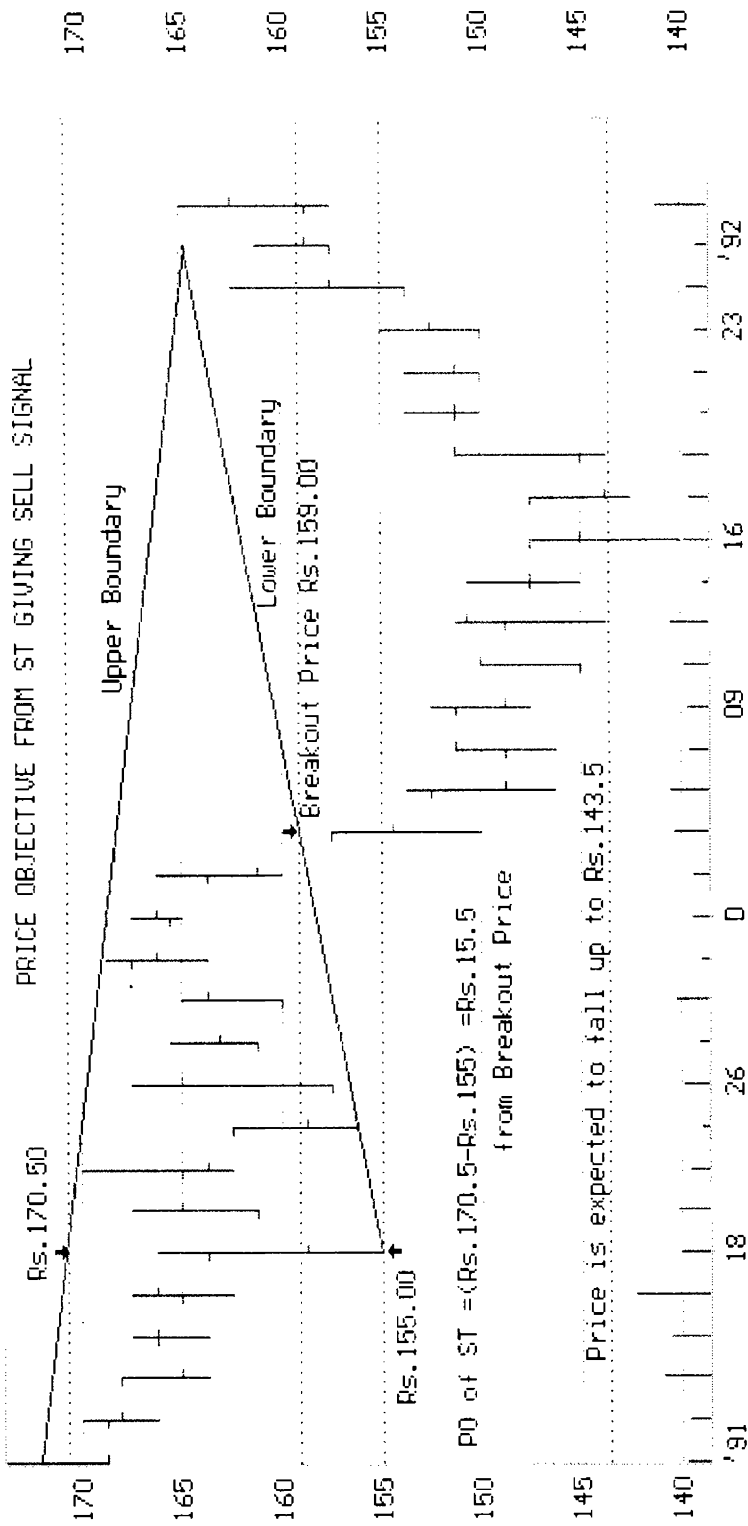
Chart 4.2 Price Objective of Symmetrical Triangle With Buy Signal

Source: BSE Data, Chart drawn by the Researcher in Metastock

75
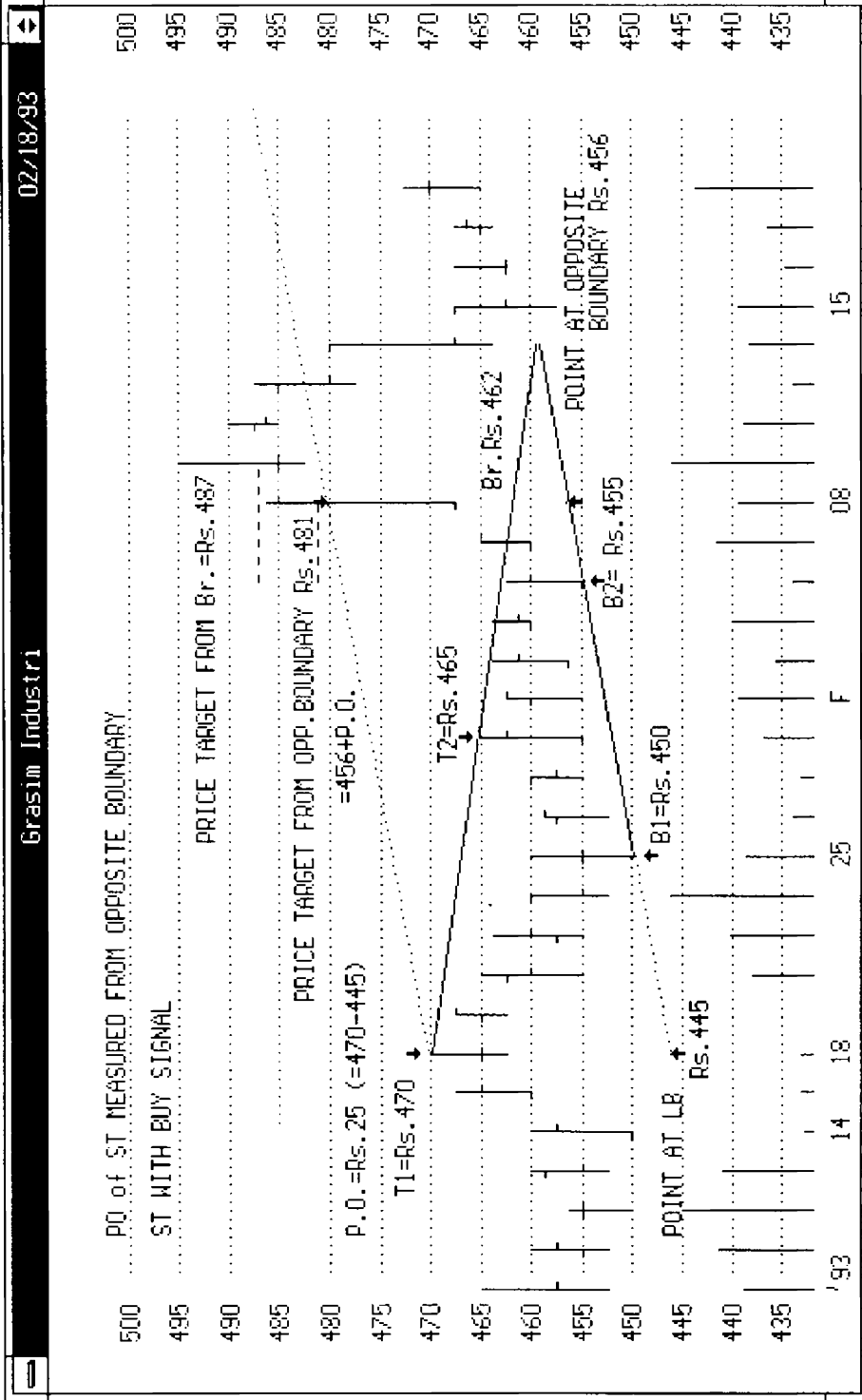
Table 4.1.2 shows the various levels of achievement of price objective as revealed by the sample analysis and the probable range of proportions of symmetrical triangles in the universe (generalised for all STs) within 95% fiducial limits.

Table 4.1.1 Achievement-wise distribution of ST according to predictability when the price objective is measured from the opposite boundary.

Percentage of PO Achieved	Reversal Day					
	First		Second		Third	
	No.	%	No.	%	No.	%
100 or more	39	23.49	64	38.55	68	40.96
75-100	34	20.48	21	12.65	22	13.25
50-75	58	34.94	38	22.89	33	19.88
25-50	28	16.87	24	14.46	15	9.04
less than 25	7	4.22	19	11.45	28	16.87
Total	**166**	**100**	**166**	**100**	**166**	**100**

Table 4.1.2 The Standard Error and 95% Fiducial Limit range values of various proportions of STs achieving different levels of Price Objective measured from opposite boundary.

P.O. Achievement	First Reversal Day			Second Reversal Day			Third Reversal Day		
	S.E	Range of proportions		S.E	Range of proportions		S.E	Range of proportions	
		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.
>=100%	1.784	**19.997**	**26.991**	2.953	**32.766**	**44.343**	3.140	**34.809**	**47.119**
75-100%	1.550	17.443	23.521	0.942	10.804	14.497	0.989	11.314	15.192
50-75%	2.673	29.701	40.178	1.737	19.486	26.297	1.504	16.932	22.827
25-50%	1.270	14.379	19.356	1.083	12.336	16.580	0.661	7.740	10.332
<25%	0.286	**3.657**	**4.777**	0.849	**9.782**	**13.109**	1.270	**14.379**	**19.356**

According to the Table 4.1.2, on the first reversal day, the universal proportion of successful symmetrical triangles (that is, achieving the traditionally held level (100%) of price objective) can range from a minimum of 19.997% to a maximum of just 26.991% of the total number of symmetrical triangles that occur in stock charts. The lower and upper probability values in percentage are 32.766 and 44.343 on the

second reversal day and 34.809 and 47.119 on the third reversal day. So in no case, all the STS, found in the stock charts, achieved their traditional price objective. The best expectation possible is, even if one waits till the third reversal day, only 47.119% (less than half) of the STs are found successful in the traditional view. Given the above standard error values, the probability of successful STs reaches only 47.119% at mean plus 1.96 times of standard error. The proportion of successful STs means the probability of their success in the prediction in the traditional way. The probability is always less than fifty percent (the maximum being 47.119% even on the latest reversal day considered). It means that more than half the number of STs fail in their traditional predictability.

Trend wise analysis of symmetrical Triangles

Though the price move, on the breakout from symmetrical triangle pattern, in general, do not conform to the traditional holding, further analysis has been done to identify whether there is any difference in performance during different trends. This is an attempt to capture the trend wise difference in the validity of traditional holding and also the trend wise superior benefits, if any.

Trend Wise Proportion of Symmetrical Triangles

Of the 166 symmetrical triangles, 108 are found to have occurred during the period of up trends and 58 during the period of down trends. To find out whether the difference is significant or not, a test of significance for difference between proportions had been conducted. The result is in the Table 4.1.3. Since the quotient (8.139) exceeds 1.96, it can be concluded that symmetrical triangles in up trends outnumber those in down trends.

Table 4.1.3 Test of significance for difference between trend wise proportions of STs		
Standard Error	Difference between Proportions	Difference / S.E.
0.037005284	0.30	8.139508365

Trend wise probability of Successful Symmetrical Triangles

All the symmetrical triangles were further examined trend wise to know whether success and failure are significantly different for them during different trends on different reversal days. The results obtained there on are presented in Table 4.1.4, Table 4.1.5 and Table 4.1.6. These Tables show that there is no significant difference between the probability of successful STs in up trend and down trend. This is true in all the different classes of achievement and on all the reversal days.

Table 4.1.4 Trend-wise and Achievement-wise Distribution of STs on the First Reversal Day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of STs	% of total	Number of STs	% of total		
100% or more	13	22.41	26	24.04	0.069017	0.240562
75-100	13	22.41	21	19.44	0.065697	0.451975
50-75	17	29.31	41	37.96	0.077615	1.114812
25-50	12	20.69	16	14.81	0.060959	0.963735
less than 25	3	5.17	4	3.70	0.032717	0.448919
Total	**58**	**100.00**	**108**	**100.00**		

Table 4.1.5 Trend-wise and Achievement-wise Distribution of STs on the Second Reversal Day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference /S.E.
	Number of STs	% of total	Number of STs	% of total		
100% or more	23	39.66	41	37.96	0.079234	0.213572
75-100	8	13.79	13	12.04	0.054115	0.324509
50-75	13	22.41	25	23.15	0.068394	0.107372
25-50	8	13.79	16	14.81	0.057249	0.178467
less than 25	6	10.34	13	12.04	0.051827	0.326512
Total	**58**	**100.00**	**108**	**100.00**		

Table 4.1.6 Trend-wise and Achievement-wise Distribution of STs on the Third Reversal Day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference /S.E.
	Number of STs	% of total	Number of STs	% of total		
100% or more	28	48.28	40	37.04	0.080055	1.403891
75-100	5	8.62	17	15.74	0.055197	1.289943
50-75	10	17.24	23	21.30	0.064969	0.624136
25-50	5	8.62	10	9.26	0.046672	0.136821
less than 25	10	17.24	18	16.67	0.060959	0.094278
Total	**58**	**100.00**	**108**	**100.00**		

Trend wise performance of Symmetrical Triangles

A further analysis has also been made to know whether achievement levels of price objectives are significantly different during different trends on different reversal days. The observed sample result shows that the mean percentage of achievement of price objective by 'STs that occurred during down trends' is higher than the same for 'STs occurred during up trends' (Table 4.1.7). A test of significance for difference between means, however, does not support this difference in their performance as significant.

Thus in respect of 'the probability of success' and 'achievement level of price objective', symmetrical triangles are indifferent to trends. This is true on all the three reversal days.

Table 4.1.7 Trend wise Statistics on Achievement of P.O. by ST

Statistic	Reversal Day					
	First		Second		Third	
	Down	Up	Down	Up	Down	Up
Mean	82.19	79.28	99.58	78.54	106.94	103.99
Maximum	248.50	218.32	460.58	820.92	419.71	1398.71
Minimum	10.73	18.39	-48.57	-1009.37	-61.52	-170.03
Std. Deviation	49.22	42.34	78.16	166.40	96.05	154.88
Median	69.91	68.09	85.70	75.18	92.93	79.11
	Up and Down		Up and Down		Up and Down	
S.E. of Means		7.64032		19.01808		19.52374
Difference/ S.E.		0.380917		1.106208		0.151203

Signal wise analysis of Symmetrical Triangles

Signal wise analysis is also made to ascertain the superiority of performance, if any, of STs with either of the signals over the other. The signal wise performance is also cross-analysed trend wise to know the differences in performance of STs with different signals, in different trends.

Signal wise Proportion of symmetrical triangles.

Of the 166 symmetrical triangles, 84 gave buy signals while the rest 82 gave sell signals. The proportion of STs with either of the signals does not significantly vary from that with the other signal. The signal-wise indifference in the frequencies is supported by the test in the Table 4.1.8. So 'buy signal STs' and 'Sell Signal STs' occur almost with same frequency.

Table 4.1.8 Test of significance for difference between signal wise proportions of STs

Standard Error	Difference between Proportions	Difference / S.E.
0.03880471	0.01	0.31048

However a further probe into the signal-wise probability reveals the following.

Signal wise Probability of successful symmetrical Triangles

On the first reversal day, the probability of STs with 'buy signals' achieving their full (100%) price objective is significantly higher than (different from) that of STs giving sell signals. When 30.95% of the 'buy signal Sts' achieved their price objective in full (100 or more), only 15.85% of the 'sell signal STs' could achieve their price

80

objective to that extent. Similar difference is seen in the category of achievement level between 25% and 50% (see Table 4.1.9)

On the second reversal day, the probability of successful buy signal STs is higher (45.24%) compared to the same for sell signal STs (31.71%) in the observed sample result. However the difference is not significant as shown by the statistical test values which are always less than 1.96. Thus, a significant difference in probability of success is not visible in any category on the second reversal day (Table 4.1.10).

Again on the third reversal day, as revealed by Table 4.1.11, significant difference is not visible except in the category of achievement level less than twenty five percent. In the category with less than 25% achievement (lowest level) on this day the 'buy signal STs' are fewer in number compared to 'sell signal STs'. It (smaller proportion for lowest performance means greater proportion for higher performance) also supports the improved probability of buy signal STs to succeed better than the sell signal STs. So in general, 'STs with buy signals' are more dependable to act up on.

Table 4.1.9 Signal -wise and Achievement-wise Distribution of STs on the First Reversal Day

% of P.O. achieved	Buy Signal		Sell Signal		S.E	Difference /S.E.
	Number of STs	% of total	Number of STs	% of total		
100% or more	26	30.95	13	15.85	0.065816	**2.29407**
75-100	18	21.43	16	19.51	0.062651	0.305883
50-75	28	33.33	30	36.59	0.074016	0.439369
25-50	9	10.71	19	23.17	0.058132	**2.142773**
Less than 25	3	3.57	4	4.88	0.031199	0.418796
Total	**84**	**100.00**	**82**	**100.00**		

Table 4.1.10 Signal-wise and Achievement-wise Distribution of STs on the Second Reversal Day

% of P.O. achieved	Buy Signal		Sell Signal		S.E	Difference /S.E.
	Number of STs	% of total	Number of STs	% of total		
100% or more	38	45.24	26	31.71	0.07556	1.790743
75-100	10	11.90	11	13.41	0.051605	0.292582
50-75	16	19.05	22	26.83	0.065222	1.193096
25-50	12	14.29	12	14.63	0.054595	0.063822
less than 25	8	9.52	11	13.41	0.049424	0.787239
Total	**84**	**100.00**	**82**	**100.00**		

Table 4.1.11 Signal-wise and Achievement-wise Distribution of STs on the Third Reversal Day

% of P.O. achieved	Buy Signal		Sell Signal		S.E	Difference /S.E.
	Number of STs	% of total	Number of STs	% of total		
100% or more	39	46	29	35	0.076343	1.449089
75-100	14	17	8	10	0.052637	1.31287
50-75	14	17	19	23	0.061956	1.049791
25-50	9	11	6	7	0.044508	0.763289
less than 25	8	10	20	24	0.058132	**2.557342**
Total	**84**	**100**	**82**	**100**		

82

Signal-trend analysis

To ascertain superiority of performance of STs with any particular signal in either trend, a signal-trend analysis was made. All the STs occurred during the period of the same trend are again classified signal-wise and then the results were cross-examined with the results across trends and across signals.

Of the fifty-eight symmetrical triangles that occurred during down trends, thirty-eight of them were with sell signals and only the rest 20 gave buy signals. There is significant difference in the frequencies of symmetrical triangles with different signals across trends as revealed by the test of significance for difference between proportions (Table 4.1.12).

Table 4.1.12 Test of significance for difference between signal wise proportions of STs occurred during **down** trends

Standard Error	Difference between Proportions	Difference / S.E.
0.062411527	0.31	4.9725

The reverse is true in the case of symmetrical triangles in up trends. Of the hundred and eight symmetrical triangles that occurred in up trends, sixty-four of them are with buy signals and only the rest 44 gave sell signals (Table 4.1.13).

Table 4.1.13 Test of significance for difference between signal wise proportions of STs occurred during **up** trends

Standard Error	Difference between Proportions	Difference / S.E.
0.047280351	0.19	3.9167

To examine whether performance of STs giving either of the signals are superior to those giving the other signal, the total number of symmetrical triangles were classified according to the signals they generate that is 'buy signal' or 'sell signal' and the achievement of price objective by each class.

The Table 4.1.14 shows that symmetrical triangles occurred during down trend periods and giving 'sell signals' achieved their price objective in more proportion than the symmetrical triangles giving buy signals. On the first reversal day 23.68% of the sell signal STs achieved their price objective in full when it was only 20.00% for buy signal STs. Observed values show that in performance also they maintain the same position (4.1.16) During down trends, the mean and median achievement of sell signal STs is higher than that of buy signal STs on all the three reversal days. However, difference is not statistically significant.

The Table 4.1.15 shows that during up trend periods, 'buy signal STs' achieved their price objective in more proportion than the 'sell signal STs'. The same dominance is also seen in the achievement level. Table 4.1.17 depicts that during up trend periods, 'buy signal STs' out performed 'sell signal STs'. The difference in performance is also supported by the statistical test (last row of the table) on the first and second days . It is unlike the superiority of 'sell signal STs during down trends', which is not statistically significant. This gives a conclusion that in respect of predictability during up trend periods, symmetrical triangles giving buy signals are better than symmetrical triangles giving sell signals.

Table 4.1.14 Achievement wise, Reversal day wise and Signal-wise Proportion (in %) of 58 STs occurred during Down Trends

% of P.O. achieved	First Reversal Day		Second Reversal Day		Third Reversal Day	
	Buy	Sell	Buy	Sell	Buy	Sell
100% or more	**20.00**	**23.68**	**25.00**	**47.37**	**35.00**	**55.26**
75-100	25.00	21.05	10.00	15.79	15.00	5.26
50-75	30.00	28.95	30.00	18.42	15.00	18.42
25-50	20.00	21.05	20.00	10.53	10.00	7.89
less than 25	5.00	5.26	15.00	7.89	25.00	13.16
Total of Proportions	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Total Number of STs	20	38	20	38	20	38

Table 4.1.15 Achievement wise, Reversal day wise and Signal -wise Proportion (in %) of 108 STs occurred during Up Trends

% of P.O. achieved	First Reversal Day		Second Reversal Day		Third Reversal Day	
	Buy	Sell	Buy	Sell	Buy	Sell
100% or more	**34.38**	**9.09**	**51.56**	**18.18**	**50.00**	**18.18**
75-100	20.31	18.18	12.50	11.36	17.19	13.64
50-75	34.38	43.18	15.63	34.09	17.19	27.27
25-50	7.81	25.00	12.50	18.18	10.94	6.82
Less than 25	3.13	4.55	7.81	18.18	4.69	34.09
Total of Proportions	100.00	100.00	100.00	100.00	100.00	100.00
Total Number of STs	64	44	64	44	64	44

It may be said that 'Buy signal STs' and 'Sell signal STs' perform alike in down trends but 'Buy signal STs' outperform "Sell signal STs' in up trends. The superiority of 'Buy signal STs during up trends' periods is more reliable in the technical prediction. Reading Tables 4.1.14 to 4.1.17 together, probability of success is higher for actions in the line of the trend while using signals from Symmetrical Triangles.

Table 4.1.16 Signal wise Statistics on Achievement of P.O. by ST occurred during Down trends

Statistic	Reversal Day					
	First		Second		Third	
	Buy	Sell	Buy	Sell	Buy	Sell
Mean	73.65	86.69	75.98	112.00	82.82	119.63
Maximum	124.00	248.50	201.92	460.58	254.32	419.71
Minimum	12.44	10.73	-12.50	-48.57	-46.68	-61.52
Std. Deviation	32.03	56.09	55.28	85.91	75.95	103.78
Median	66.31	69.91	66.49	92.92	74.72	106.87
	Buy and Sell		Buy and Sell		Buy and Sell	
S.E. of Means	11.57945		18.62858		23.91252	
Difference/ S.E.	1.126002		1.933816		1.539673	

Table 4.1.17 Signal wise Statistics on Achievement of P.O. by ST occurred during Up Trends

Statistic	Reversal Day					
	First		Second		Third	
	Buy	Sell	Buy	Sell	Buy	Sell
Mean	90.85	62.46	97.02	51.66	142.83	47.48
Maximum	218.32	130.77	820.92	240.01	1398.71	232.01
Minimum	21.50	18.39	-1009.37	-201.02	-40.17	-170.03
Std. Deviation	47.47	25.90	205.53	75.89	182.66	72.78
Median	77.55	59.18	104.30	58.37	100.23	64.04
	Buy and Sell		Buy and Sell		Buy and Sell	
S.E. of Means		7.103247		28.12396		25.33219
Difference/ S.E.		**3.996447**		1.612988		**3.763883**

Time Lag up to Reversal Days

Of the 166 symmetrical triangles, 27 symmetrical triangles were having their reversal day on the breakout day itself. For the rest 139 STs, the period from 'breakout day' to the third reversal days' ranged from a single day to seventy-nine days (Table 4.1.18).

The average time lag till the first, second and third reversal days were four (4.33), fifteen (14.78) and twenty six (26.11) days respectively. The minimum periods (most optimistic) were 1, 2, and 9 days for the first, second and third reversal days[65]. The minimum period shows shortest period of days within which the prices reversed after breakout. The maximum periods (most pessimistic) were 21, 50 and 79 days respectively for first, second and third reversal days.

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[65] *Excluding the 27 symmetrical triangles which experienced a price reversal on the same of breakout itself.*

Table 4.1.18 Reversal Day-wise time lag for the achievement of price objective by Symmetrical Triangles

Statistic	No of Days 'in the Market' on the Reversal Day			Percentage of P.O. Achieved on the Reversal Day		
	First	Second	Third	First	Second	Third
Mean	4.33	14.78	26.11	80.30	85.89	105.02
Median	3.00	13.00	22.00	69.30	76.73	82.22
Minimum	1.00	2.00	9.00	10.73	-1009.37	-170.03
Maximum	21.00	50.00	79.00	248.50	820.92	1398.71

Significance of Volume

Volume is expected decline during the formation period of this pattern as it is a period of confusion. The volume is expected to improve at breakout as it implies confirmation or decision of pending issues. There are five different, relevant price-point days in the formation and breakout of a Symmetrical Triangle pattern. They are:

1. The day of First Top (T1),

2. The day of Second Top (T2),

3. The day of First Bottom (B1),

4. The day of Second Bottom (B2) and

5. The day of Breakout (Br.)

These price points are turning points in the price series. Therefore, the volumes traded at all these five relevant days were examined to know whether the volume is in accordance with the traditional expectation.

The Table 4.1.19 shows that on the average, better volumes were experienced on the breakout (Br) day and at the initial periods-on the day of formation of first top (T1) and the first bottom (B1) with the respective volume quotient being 1.263, 1.196 and 1.156. The Highest of the **Maximum** volume is also with the first

bottom (B1) with the quotient being 7.655. The 'declining volume as the pattern completes' confirms that the traditional holding with respect volume is correct in the case of symmetrical triangles.

Table 4.1.19 Volume Quotients at different price points in STs

Price Point Day	Average	Minimum	Maximum
First Top	1.19588	0.00012	4.45498
Second Top	0.94483	0.00012	3.47184
First Bottom	1.15616	0.00003	7.65482
Second Bottom	1.12985	0.00009	4.65438
Breakout	1.26309	0.00005	5.82533
Grand Average	**1.13796**	**0.00008**	**5.21227**

Demand and Supply Forces within the Pattern and Achievement of Price Objective

Demand and supply forces indicates the intensity of the actions of the buyers and sellers. Balance in in either means the dominence of one group over the other and consequent price behaviour favouring the dominent group. To ascertain the influence of 'demand and supply balances within the pattern' on the 'extent of achievement of price objective', correlation co-efficient between them is found out and tested. The relationship of five different 'candles', explained earlier, to 'the achievement of price objective' is examined and the result thereof is given below.

Trend wise analysis of relationship

The tables 4.1.20, 4.1.21 and 4.1.22 depict the trend-wise simple correlation co-efficient between achievement of price objective and the different types of candles with their respective probable error values, on the first, second and third reversal days respectively. These tables show that there exists positive relationship between

88

achievement of price objective and the number of Doji line '⊥' (inverted T type) in all the trends. In all other cases, there is inverse relationship as revealed by the negative co-efficient of correlation.

Table 4.1.20 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the First Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0259	0.6744565	-0.2990	0.6665842	-0.1440	0.673414779
Black	-0.0594	0.6742709	-0.1244	0.6731293	-0.0896	0.674080083
Doji +	-0.0403	0.6743944	-0.1197	0.6732317	-0.0692	0.674249036
Doji T	-0.0310	0.6744377	-0.1954	0.6711189	-0.1034	0.673939772
Doji T (Inverted T)	0.0881	0.6739965	0.0677	0.6740936	0.0800	0.674164629

Table 4.1.21 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Second Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	R	P.E.r	r	P.E.r
White	0.0635	0.6742384	-0.1666	0.6720427	0.0193	0.674480505
Black	-0.0902	0.6739724	-0.1815	0.6715829	-0.1062	0.673909915
Doji +	-0.1139	0.6736577	-0.1123	0.673384	-0.1042	0.67393148
Doji T	0.0577	0.6742841	-0.1906	0.6712812	0.0051	0.674498612
Doji (Inverted T)	-0.0749	0.6741357	-0.0232	0.6744525	-0.0270	0.674461896

Table 4.1.22 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Third Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	R	P.E.r	r	P.E.r
White	-0.0140	0.6744872	-0.0758	0.6739907	-0.0280	0.674459008
Black	-0.0550	0.6743034	-0.2115	0.6705385	-0.0929	0.67404787
Doji +	-0.1440	0.6731539	-0.1068	0.6734898	-0.1311	0.673600761
Doji T	-0.0239	0.6744629	-0.1568	0.6723217	-0.0582	0.674322975
Doji (Inverted T)	0.0280	0.6744491	-0.0343	0.6743958	0.0051	0.674498625

89

Signal wise analysis of relationship

The tables 4.1.23, 4.1.24 and 4.1.25 depict the signal-wise simple correlation co-efficient between achievement of price objective and the different types of candles with their respective probable error values, on the first, second and third reversal days respectively.

Table 4.1.23 Signal wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the First Reversal Day

Candles	Buy signal		Sell Signal		Combined	
	r	P.E.r	R	P.E.r	r	P.E.r
White	0.0092	0.6744945	-0.2315	0.6697534	-0.1440	0.673414779
Black	-0.1301	0.6734021	-0.0976	0.673656	-0.0896	0.674080083
Doji +	0.0141	0.6744871	-0.1675	0.6720166	-0.0692	0.674249036
Doji T	-0.0708	0.6741751	-0.1283	0.6730424	-0.1034	0.673939772
Doji (Inverted T)	0.1321	0.6733675	0.0612	0.6741683	0.0800	0.674164629

Table 4.1.24 Signal wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Second Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	0.0395	0.6743986	0.0105	0.6744903	0.0193	0.674480505
Black	-0.1673	0.6726826	0.0142	0.674482	-0.1062	0.673909915
Doji +	-0.0169	0.6744814	-0.3391	0.664318	-0.1042	0.67393148
Doji T	0.0086	0.6744952	0.0030	0.6744992	0.0051	0.674498612
Doji (Inverted T)	-0.0655	0.6742211	0.0210	0.6744611	-0.0270	0.674461896

Table 4.1.25 Signal wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Third Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0453	0.6743671	0.0481	0.6742947	-0.0280	0.674459008
Black	-0.1461	0.6731145	-0.0877	0.6738192	-0.0929	0.67404787
Doji +	-0.0355	0.6744181	-0.3435	0.66405	-0.1311	0.673600761
Doji T	-0.0816	0.6740683	-0.0271	0.674435	-0.0582	0.674322975
Doji (Inverted T)	-0.0139	0.6744875	0.0488	0.674289	0.0051	0.674498625

The relationship between achievement of price objective and the occurrence of different types of candles is always very little or absent. With most candles achievement is negatively correlated. However the relationship is not significant as the probable error of co-efficient of correlation is always much greater than the co-efficient of correlation itself. This is true in both the trends and both the signals. So it may be said that Demand ansd Supply balances (reflected by candles) within symmetrical triangle patterns and achievement of price objective are independent.

Summary of the results

During a period of fourteen years there were only 166 Symmetrical Triangles for ten stocks. So one may expect, on the average, seventeen (16.6) symmetrical triangles per stock. Their frequency of occurrence implies that 'the nature of the pattern 'symmetrical triangle to reoccur' continues to be valid in the stock charts of Indian companies. However, as number of patterns (signals) are very few, this pattern can not be used for frequent trades. One who buys or sells strictly on signals from symmetrical triangles, can realise only 47.119 (even theoretically) percent of his expectations in full even after waiting till the third reversal day.

The minority of successful STs means that the traditional holding with respect to the price behaviour after the occurrence of a Symmetrical Triangle pattern is not correct and so price behaviour in the traditional view after the occurrence of a symmetrical triangle pattern is not applicable in Indian stock market. So the test rejects the hypothesis that 'symmetrical triangles achieve their traditional price objective' (test in Table 4.1.2). Hence, they do not have predictive capacity at least in this respect.

Symmetrical triangles are found to succeed and fail in both the trends alike and hence no preference need be given to STs occurred during either of the trends to that occurred during the other trend.

91

In general, the proportion of symmetrical triangles with either of the signals do not significantly vary from that with the other signal. However, signal-wise proportion differs within a trend. Symmetrical triangles favour the respective trend where they occur. That is, if a symmetrical triangle occurs in a down trend, there is more chance for it to break the lower boundary and give a sell signal than to give a buy signal. Conversely a symmetrical triangle in an up trend is more likely to give a buy signal. Therefore, it may be remarked that STs mostly occur as continuation pattern rather than a reversal pattern.

The probability of success during down trend periods is higher for STs with sell signals than that for STs with buy signals. The reverse is true in up trend periods. Anti-trend actions (buy during down trends or sell during up trend periods) are always less favourable compared to actions in the line of the trend. Of the generally bad anti-trend actions based on signals from STs, 'sell during up trends' is worse than 'buy during down trends'.

The relationship between 'Demand and Supply forces' and 'success of symmetrical triangle' patterns is very small.

In short, practically (from the sample information) and theoretically (from the interference from the sample) majority of symmetrical triangles do not maintain their traditional price objective and so lack predictive capacity in that sense. The probability of successful symmetrical triangles in the traditional way is less than fifty percent. Though the frequencies differ, the performance of STs does not differ across trends, but it varies within a trend based on signals. Symmetrical triangle patterns mostly occur as continuation patterns rather than reversal patterns. Price behaviours within or inside this pattern as reflected in candle formations are unable to independently explain the post-pattern price behaviour as occurrence of candles and success or failure of Symmetrical Triangles are found little correlated.

SECTION 4.2

RISING WEDGE ANALYSIS

The construction of a Rising Wedge pattern is explained in the third chapter. Traditionally, this pattern is expected to give only a sell signal. It is when the price, after the formation of the pattern, moves downward and breaks its lower boundary. In respect of signal generation, there is a difference between a symmetrical triangle pattern and a rising wedge pattern. Symmetrical triangles may give valid buy or sell signals, but in the case of rising wedges only sell signals are considered valid. This section examines rising wedges with valid (sell) signals only.

Price Objective of a Rising Wedges (RW)

The price objective of a Rising Wedge is taken to be the difference between the 'price at the first bottom' of this pattern and the 'price at its second top' as shown in the *Chart 4.3*. According to this concept, price objective is said to be the *height of the price movement (slope)* during the formation of the rising wedge[66]. That is, the post-signal price is expected to fall at least to the extent of its price objective.

Starting Point for Measuring the Price objective

The price objective of a rising wedge pattern is measured from the second top itself at the upper boundary as shown in *Chart 4.3*. If all the rising wedges achieve their price objective, at least in a statistically significant manner, then it can be confirmed that rising wedges continue to maintain their traditional predictive value.

The following are the results of analysis of rising wedges.

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[66] Plummer,Tony; Forecasting Financial Markets-the Truth Behind Technical Analysis, Kogan Page Limited London, (1989),p 142.

Chart 4.3 Price Objective of Rising Wedge

Source: BSE Data, Chart drawn by the Researcher in Metastock

Occurrence and reoccurrence of the Rising Wedge Pattern

Out of the 765 valid patterns found out, 218 were rising wedges. So patterns called rising wedges occur in the stock charts of companies in Indian stock market.

Probability of successful Rising Wedges

The probability of success is obtained from the proportion of successful rising wedges in the total number of rising wedges found. The Table 4.2.1 presents the distribution of rising wedges according to the level of achievement of their price objective.

Table 4.2.1 Achievement-wise distribution of Rising Wedges

| Percentage of PO Achieved | Reversal Days | | | | | |
| | First | | Second | | Third | |
	No.	%	No.	%	No.	%
100 or more	38	17.43	63	28.90	80	36.70
75-100	40	18.35	33	15.14	31	14.22
50-75	60	27.52	46	21.10	36	16.51
25-50	62	28.44	34	15.60	20	9.17
less than 25	18	8.26	42	19.27	51	23.39
Total	**218**	**100.00**	**218**	**100.00**	**218**	**100.00**

The table 4.2.1 shows that only 17.43% of the Rising Wedges could achieve their price objective in full on the first reversal day. This was 28.90% and 36.70% for the second and the third reversal days respectively. However, the observed sample values do not support the holding that RWs achieve their traditional price objective.

Table 4.2.2, using the test of significance for proportion of success, shows the probable range of successful rising wedges in the universe (generalised for all RWs) within 95% fiducial limits. The proportion of successful RWs means the probability of their success in the prediction in the traditional way. These probabilities, as we can see in the table, are always less than fifty percent (the maximum being 43.10% even on the latest reversal day considered). It means that more than half the number of RWs fails in their traditional holding with respect to their predictability.

According to the Table 4.2.2, on the first reversal day, the universal proportion of successful RWs (that is, achieving the traditional price objective) can range from a minimum of 12.40% to a maximum of just 22.50% of the total number of RWs that occur in stock charts. The lower and upper probability values in percentage are 22.90 and 34.90 on the second reversal day and 30.30 and 43.10 on the third reversal day. So theoretically in no case all the RWs can be expected to achieve their traditional price objective. The best expectation possible is, even if one waits till the third reversal day, only 43.1% (less than half) of the RWs, successful in the traditional view.

Table 4.2.2 The Standard Error and 95% Fiducial Limit range values of various proportions of RWs achieving different levels of Price Objective

P.O. Achievement	First Reversal Day			Second Reversal Day			Third Reversal Day		
	S.E	Range of proportions		S.E	Range of proportions		S.E	Range of proportions	
		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.
>=100%	2.57	12.40	22.47	3.07	22.88	34.92	3.26	30.30	43.10
75-100%	2.62	13.21	23.49	2.43	10.38	19.90	2.37	9.58	18.86
50-75%	3.02	21.59	33.45	2.76	15.68	26.52	2.51	11.58	21.44
25-50%	3.06	22.45	34.43	2.46	10.78	20.41	1.96	5.34	13.01
<25%	1.86	4.60	11.91	2.67	14.03	24.50	2.87	17.77	29.01

Trend wise Analysis of Rising wedges

The Rising Wedges were further examined to know whether achievement of price objective is different during different trends. Result of this analysis is presented in Tables 4.2.3- 4.2.6.

Trend Wise Proportion of Rising Wedges

Of the 218 Rising Wedges, 62 are found to have occurred during the period of down trends and the rest 156 Rising Wedges during the period of up trends. The trend wise difference in their frequency implies that Rising Wedges are more frequent

in up trends than in down trends. The Table 4.2.3 shows that the frequencies of RWs differ significantly in the two trends.

Table 4.2.3 Test of significance for difference between trend wise proportions of Rising Wedges

Standard Error	Difference between Proportions	Difference / S.E.
0.030554	0.431193	14.11231

Trend wise probability of Successful Rising Wedges

Tables 4.2.4, 4.2.5 and 4.2.6 show that higher proportion of rising wedges that occurred during down trends achieved their price objective on the first, second and third reversal days than that of rising wedges occurred during up trends. For these respective days, the proportions of successful rising wedges (in the traditional view) were 35.48, 50.00 and 54.84 in down trends as against 22.44, 35.90 and 39.10 in up trends. Thus, it is found that rising wedges are more successful if they occur in downtrends than in up trends. The difference is found statistically significant on the first and third reversal days though not on the second reversal day (calculated value (1.35215) is less than 1.96 on the second reversal day). The probability of success is more than fifty percent (54.84) in the downtrend if waited till the third reversal day. So if a rising wedge occurs during down trend, it is more likely to succeed than to fail. However Rising Wedges in down trends are fewer (62) compared to the same in up trends (156).

There is also significant difference in the proportion of wedges achieving less than 25% of their price objective in the two different trends (see last row of Tables 4.2.5 and Table 4.2.6). On the second reversal day, of the rising wedges occurred during down trend, only 9.68% ended with an achievement level less than 25% of price objective. It was worse (more RWs with low achievement) in the case of rising wedges

occurred during up trends with significantly higher percentage of 21.79[67]. The relative position was the same on the third reversal day also though these proportions increased to 8.06 and 27.56 respectively. A rising wedge forecasts fall in price and it fails more in an up trend and worsens as the days pass, it is just because of the pull of up trend itself. So it hints, reading with the similar results from the analysis of symmetrical triangles, to the fact that trend has its own long run impact.

Table 4.2.4 Trend-wise and Achievement-wise Distribution of Rising Wedges (First Reversal Day)

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of RWs	% of total	Number of RWs	% of total		
100% or more	16	25.81	22	14.10	0.05696	**2.05489**
75-100	7	11.29	33	21.15	0.05811	1.69738
50-75	21	33.87	39	25.00	0.06705	1.32298
25-50	14	22.58	48	30.77	0.06773	1.20903
less than 25	4	6.45	14	8.97	0.04132	0.61053
Total	**62**	**100**	**156**	**100**		

Table 4.2.5 Trend-wise and Achievement-wise Distribution of Rising Wedges (Second Reversal Day)

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of RWs	% of total	Number of RWs	% of total		
100% or more	22	35.48	41	26.28	0.06805	1.35215
75-100	9	14.52	24	15.38	0.05381	0.16140
50-75	14	22.58	32	20.51	0.06126	0.33756
25-50	11	17.74	23	14.74	0.05447	0.55045
less than 25	6	9.68	36	23.08	0.05921	2.26305
Total	**62**	**100**	**156**	**100**		

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[67] Smaller level achievement means less successful

Table 4.2.6 Trend-wise and Achievement-wise Distribution of Rising Wedges (Third Reversal Day)

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of RWs	% of total	Number of RWs	% of total		
100% or more	30	48.39	50	32.05	0.07236	**2.25758**
75-100	11	17.74	20	12.82	0.05243	0.93859
50-75	9	14.52	27	17.31	0.05574	0.50078
25-50	6	9.68	14	8.97	0.04334	0.16223
Less than 25	6	9.68	45	28.85	0.06356	3.01604
Total	**62**	**100**	**156**	**100**		

Trend wise performance

The Table 4.2.7 shows that on the first, second and third reversal days, the respective means of achievement of price objective were 76.02%, 86.85% and 102.83% by rising wedges occurred during down trends. These respectively were lower at 64.51%, 61.29% and 57.35% for rising wedges occurred during up trends. The difference is found significant except on the first reversal day when the calculated value (1.6175) is less than 1.96. It means longer waiting is better for actions made on signals from rising wedges occurred during down trends. In other words, for immediate actions, signals from rising wedges occurred during either up or down trend are alike.

Judging by median achievement also, rising wedges occurred during down trends are better performing.

Table 4.2.7 Trend wise Statistics on Achievement of P.O. by RW

Statistic	Reversal Day					
	First		Second		Third	
	Down	Up	Down	Up	Down	Up
Mean	76.02	64.51	86.85	61.29	102.83	57.35
Maximum	336.20	228.75	320.00	227.78	292.00	393.27
Minimum	-9.75	-33.33	-59.15	-226.92	-60.00	-392.61
Std. Deviation	50.07	39.98	66.40	66.33	74.54	118.74
Median	61.72	56.92	74.22	63.89	92.67	68.33
	Down and Up		Down and Up		Down and Up	
S.E. of Means		7.1189926		9.965597		13.416579
Difference/ S.E.		1.6175		**2.564**		**3.3899**
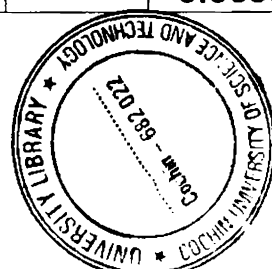
The probability for rising wedges to be successful is more in down trends (Tables 4.2.4-4.2.6). They are better achievers if occurred during down trends (Table 4.2.7). Thus, in respect of the probability of successful pattern as well as the achievement level, rising wedges have more favourable position and performance if they occur during down trend periods. That is, generally price falls (correction of previous up move) after the formation of a rising wedge. But the post-pattern fall is more in down trend compared to the same in up trend periods. That is why the achievement level of price objective was higher for rising wedges occurred during down trends. It was smaller for those in up trends (Tables 4.2.7). That is, immediate post-RW prices hesitate to fall during up trend periods. These further confirm that price, after rising wedge formation, tend to maintain, and goes back to its, main trend irrespective of the direction.

Time Lag up to Reversal Days

Of the 218 Rising Wedges analysed, 32 Rising Wedges had the reversal day (i.e., reaching the next lowest price) on the breakout day itself. So it is a caution to the investor not to act prematurely, that is, just on seeing the rising wedge and before getting signal[68]. For the rest 186 RWs, the period from 'breakout day' to 'the first, second and third reversal days' ranged from a single day to eighty-two days (Table 4.2.8).

On the average, it took four (4.27), fifteen (14.80) and twenty eight (28.23) days respectively, after breakout, for the prices to reach the first, second and third reversal days. It shows on the average, a trader need to wait only so many days for a reversal of price after breakout of price from Rising Wedge patterns. The minimum periods (most optimistic) were 1, 2, and 3 days for the first, second and third reversal

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[68] The occurance of rising wedges is a bearish omen.

100

days[69]. The maximum periods (most pessimistic) were 23, 39 and 82 days respectively for first, second and third reversal days. In other words, he should expect a reversal within these periods after breakout.

Table No. 4.2.8 Reversal Day-wise time lag for achievement of price objective by Rising Wedges

Statistic	No of Days from breakout days to the Reversal Day			Percentage of P.O. Achieved on the Reversal Day		
	First	Second	Third	First	Second	Third
Mean	4.27	14.80	28.23	67.78	68.56	70.28
Median	4.00	13.00	26.50	58.37	67.91	78.52
Minimum	1.00	2.00	3.00	-33.33	-226.92	-1539.93
Maximum	23.00	39.00	82.00	336.20	320.00	393.27

Significance of Volume

Traditional holding is that volume may dwindle during formation of the pattern and increase at breakout particularly if the signal is to buy. Since rising wedges are bearish patterns, increase in volume at breakout is not essential to confirm a breakout as a valid sell signal. The study found that from the beginning of the formation of rising wedge patterns and till they complete, the volume showed a mixed response.

There are five different, relevant price-point days in the formation of a Rising Wedge pattern till and including breakout as same explained for pattern in Section 4.1. The volume traded were examined at the following five relevant points of the Rising Wedge patterns.

1. The day of First Top (T1),

2. The day of Second Top (T2),

3. The day of First Bottom (B1),

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[69] *Excluding the 32 rising wedges that experienced a price reversal on the same of breakout itself.*

4. The day of Second Bottom (B2) and

5. The day of Breakout (Br.)

The Table 4.2.9 shows that on an average, better volumes were experienced on the days of formation of first bottom (B1) and the first Top (T1) and second Top (T2) with the respective volume quotient being 1.1358, 1.1298 and 1.1121. Highest of the Maximum volume is with the Second Top (T2) with the quotient being 6.0674, indicating that the current volume on Second Top (T2) days have come to 6.0674 times of the average volume for the nine days immediately preceding T2 day. It hints about an overbought situation the correction of which results in subsequent price fall.

Table 4.2.9 Volume Quotients at different price points in Rising Wedges

Price Point Day	Average	Minimum	Maximum
T1	1.1298	0.000015	4.2724
T2	1.1121	0.000022	6.0674
B1	1.1358	0.000013	3.8955
B2	1.0292	0.000221	3.4893
Br.	0.9415	0.000083	3.8649
Grand Average	**1.0697**	**0.000071**	**4.3179**

In, at least, fifty percent of the 218 rising wedge formations, upward reversal after the 'breakout fall' has happened within four trading days (see median time lag till first reversal day in Table 4.2.7). It means recovery within short duration. There should be demand balance if prices are to rise. This, together with the findings from Tables 4.2.4-4.2.7 (mentioned earlier for RWs in down trend periods), leads one to conclude and confirm the favouritism of 'the price behaviour following a rising wedge pattern' to be with the main trend.

Declining volume during formation supports the traditional holding. At breakout volume did not increase, which is also not a necessity traditionally.

Relationship Between Demand & Supply Forces and Achievement of Price Objective

The five different candles used in this section to evaluate the relationship between the 'demand and supply forces' and the 'achievement of price objective' are exactly the same as used in Section 4.1. The relationship is tabulated trend wise and in combined form.

Trend wise and Combined Relationship

The tables 4.2.10, 4.2.11 and 4.2.12 depict the trend-wise simple correlation co-efficient between achievement of price objective and the different types of candles with their respective probable error values, on the first, second and third reversal days respectively. These tables show that most often there exists positive relationship between achievement of price objective and the number of 'Doji lines T' (T type) and 'Doji lines ⊥' (inverted T type) in all the trends. With the other three candles, the achievement is found inversely related most often.

On the first reversal day, positive relation found between achievement and white candles and 'Doji lines ⊥' (inverted 'T' type) during down trends is very small. Such relation of white candle is, however, not visible in the combined result.

On the second reversal day the black candles are also found related in the same way. Achievement has the same relation on the third reversal day with both white candles and black candles. That also is not visible in the combined result on the third reversal day.

Table 4.2.10 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the first Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.1681	0.6726667	**0.0491**	0.6742865	-0.1021	0.673954202
Black	-0.3044	0.6684845	-0.1691	0.6719686	-0.2686	0.670721827
Doji +	-0.1021	0.6738236	-0.1897	0.6713131	-0.1301	0.673614103
Doji T	-0.1099	0.6737167	-0.0604	0.6741773	-0.0792	0.674171313
Doji line ⊥ (Inverted T)	-0.0207	0.6744721	**0.0502**	0.6742766	**0.0283**	0.674458146

Table 4.2.11 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Second Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0397	0.6743979	**0.0810**	0.6739183	-0.0126	0.674491639
Black	-0.1729	0.6725595	**0.0582**	0.6741997	-0.1297	0.673619013
Doji +	-0.0608	0.6742598	-0.1847	0.6714797	-0.0977	0.674000419
Doji line T	**0.0270**	0.6744528	-0.0265	0.6744378	**0.0271**	0.674461611
Doji line ⊥ (Inverted T)	**0.0430**	0.6743802	**0.0232**	0.6744524	**0.0604**	0.674309009

Table 4.2.12 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Third Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0693	0.674188	**0.0595**	0.6741861	-0.0498	0.674370153
Black	-0.1282	0.673433	**0.0199**	0.674465	-0.1177	0.67377516
Doji +	-0.0380	0.674406	-0.2148	0.6704142	-0.0752	0.674204039
Doji line T	**0.0137**	0.6744879	-0.0378	0.6743736	**0.0206**	0.674477744
Doji line ⊥ (Inverted T)	**0.0253**	0.6744584	-0.0391	0.6743646	**0.0357**	0.674433146

The relationship between achievement of price objective and the occurrence of different types of candles is always very little or absent. With most candles achievement is negatively correlated. However the relationship is not significant as the 'probable error of co-efficient of correlation' is always much greater than the co-

104

efficient of correlation itself. This is true in both the trends and in the combined situation.

Summary of the result

The frequency of the RWs confirms the holding that the pattern called 'rising wedge reoccurs' in the stock charts of Indian companies (Table 5.1) As there were only ten companies analysed, one may expect, on the average, twenty two (21.8) rising wedges per stock during the period of fourteen years.

The minority of successful rising wedges means that price did not behave after signal from this pattern in the way traditionally expected. Hence rising wedge as a technical tool for price prediction is not valid in the Indian stock market. The test (Table 4.2.2) rejects the hypothesis that 'Rising Wedges achieve their traditionally held price objective'. Hence, the traditional view with respect to the achievement of price objective is not correct in Indian stock market.

There is significant difference in the trend-wise frequencies of occurrence of rising wedge pattern. Up trend RWs outnumber down trend RWs.

Rising wedges are more successful if they occur in downtrends than in up trends (Tables 4.2.4- 4.2.6). There is trend-wise difference in the success of this pattern. The probability of success is more than fifty percent (54.84) in the downtrend. So if a rising wedge occurs during down trend, it is more likely to succeed than to fail. But an investor gets less number of rising wedges during down trends compared to the same in up trends.

The pattern favours the respective trend where it occurs in respect of 'probability of success' as well as 'achievement level'. A rising wedge forecasts fall in price and it fails more in an up trend and worsens as the days pass, it is just because of

the pull of up trend itself. It supports the positive influence of trend on the post-pattern price behaviour.

Demand and supply forces, as reflected by candle formations, within rising wedge patterns and achievement of price objective are independent.

In short, as in the case of symmetrical triangle pattern, practically and theoretically, majority of rising wedges do not maintain their traditional price objective and so lack predictive capacity in that sense. The probability of successful rising wedges in the traditional way is less than fifty percent. So the hypothesis that 'rising wedges achieve their traditional price objective, is rejected (test in Table 4.2.2). The rising wedge patterns are more frequent in up trend periods. But both the 'probability of success' and 'performance' are better if occurred during down trend periods. That is the performance differs across trends, unlike in the case of symmetrical triangles. Rising wedges patterns mostly occur as continuation patterns rather than as reversal patterns. Price behaviours within or inside this pattern as reflected in candle formations are unable to independently explain the post-pattern price behaviour as occurrence of candles and success or failure of rising wedges are found little correlated. Thus except in respect of the trend-wise difference in performance, rising wedges and symmetrical triangles are in same position.

SECTION 4.3

FALLING WEDGE ANALYSIS

The construction of a falling wedge pattern is explained in the third chapter. Traditionally, this pattern is expected to give only a buy signal. It is when the price, after the formation of the pattern, moves upward and breaks its upper boundary. The implication of pattern is just reverse of a rising wedge.

The breaking of lower boundary of a falling wedge pattern is traditionally not at all taken as a valid sell signal. So there should be no action in the market when its lower boundary is broken. Hence no technical price prediction follows a falling wedge pattern whose lower boundary is broken. The study examines falling wedges with only valid buy signals.

Price Objective of a Falling Wedge (FW)

The price objective of a falling wedge is taken to be the difference between the 'price at the first top' of this pattern and the 'price at its second bottom' as shown in the *Chart 4.4*. According to this concept, price objective is said to be the '*depth of the price movement*' during pattern formation[70]. The price, after signal, is expected to rise at least to the extent of its price objective.

Starting Point for Measuring the Price Objective

The price objective of a falling wedge pattern is measured from the second bottom itself at the lower boundary as shown in *Chart 4.4*. The study examined whether falling wedges achieved their price objective from this point.

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[70] Plummer,Tony; Forecasting Financial Markets-the Truth Behind Technical Analysis, Kogan Page Limited London, (1989),p 142.

Chart 4.4 Price Objective of Falling Wedge

Hind.Lever Ltd

12/24/91
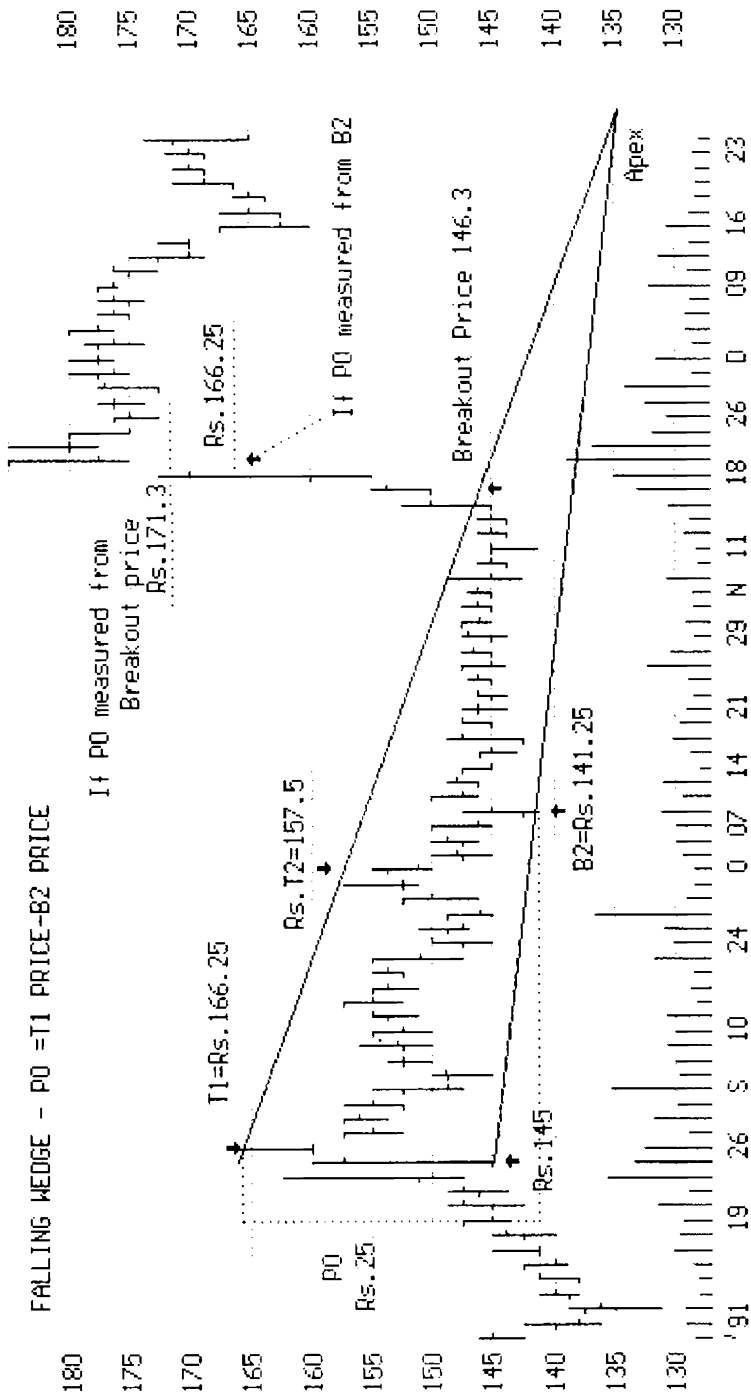
FALLING WEDGE - PO =T1 PRICE-B2 PRICE

If PO measured from
Breakout price
Rs.171.3

Rs.166.25

If PO measured from B2

Breakout Price 146.3

T1=Rs.166.25

Rs.T2=157.5

B2=Rs.141.25

PO
Rs.25

Rs.145

Apex

'91 19   26   S   10   24   O 07 14   21   29 N 11   18   26   O   09   16   23

180   175   170   165   160   155   150   145   140   135   130

180   175   170   165   160   155   150   145   140   135   130

Source: BSE Data, Chart drawn by the Researcher in Metastock

108

Occurrence and Reoccurrence of Falling Wedge Pattern

Out of the 765 valid patterns found out from the stock charts of 10 companies analysed, 238 are falling wedges. So patterns called falling wedges occur in the stock charts of companies in Indian stock market. It is the most frequent among the five patterns analysed.

Probability of Successful Falling Wedges

The probability of success is obtained from the proportion of successful falling wedges in the total number of falling wedges found. The Table 4.3.1 presents the distribution of falling wedges according to the level of achievement of their price objective. As stated earlier, those achieving 100% or more of their price objective are taken to be successful.

Table- 4.3.1 Achievement-wise distribution of Falling Wedges

Percentage of PO Achieved	Reversal Days					
	First		Second		Third	
	No.	%	No.	%	No.	%
100 or more	62	26.05	84	35.29	97	40.76
75-100	33	13.87	34	14.29	31	13.03
50-75	45	18.91	37	15.55	32	13.45
25-50	75	31.51	56	23.33	43	18.07
less than 25	23	9.66	27	11.34	35	14.71
Total	**238**	**100.00**	**238**	**100.00**	**238**	**100.00**

The table 4.3.1 shows that only 26.05% of the falling wedges could achieve their price objective in full (100%) on the first reversal day. This was 35.29% and 40.76% for the second and the third reversal days respectively. That is one who acts

(sells) strictly on signals from Falling wedges, can realise only 40.76 percent of his expectations in full even after waiting till the third reversal day.

Thus the observed sample values do not support the holding that FWs achieve their traditional price objective.

The Statistical test of significance for proportion of success (as used in the previous two Sections) gives the error in estimated proportions. It reveals the probable range of success. Table 4.3.2 shows the probable range of proportions of falling wedges in the universe (generalised for all FWs) within 95% fiducial limits. These probabilities are always less than fifty percent (the maximum being 46.999% even on the latest reversal day considered). It means that more than half the number of FWs fail in their traditional holding with respect to their predictability.

On the first reversal day, the universal proportion of successful FWs (that is, achieving the traditionally held price objective) can range from a minimum of 20.474% to a maximum of just 31.627% of the total number of FWs that occur in stock charts. The lower and upper probability values in percentage are 29.223 and 41.366 on the second reversal day and 34.513 and 46.999 on the third reversal day. So theoretically in no case all the FWs can be expected to achieve their traditional price objective.

Table 4.3.2 The Standard Error and 95% Fiducial Limit range values of various proportions of FWs achieving different levels of Price Objective

P.O. Achievement	First Reversal Day			Second Reversal Day			Third Reversal Day		
	S.E	Range of proportions		S.E	Range of proportions		S.E	Range of proportions	
		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.
>=100%	2.845	20.474	31.627	3.098	29.223	41.366	3.185	34.513	46.999
75-100%	2.240	9.475	18.256	2.268	9.840	18.731	2.182	8.749	17.301
50-75%	2.538	13.933	23.882	2.349	10.943	20.150	2.211	9.111	17.779
25-50%	3.011	25.610	37.415	2.750	18.140	28.919	2.494	13.179	22.955
<25%	1.915	5.910	13.418	2.056	7.315	15.374	2.296	10.206	19.205

Thus the theoretical values also support the findings from observed sample result as may be understood from the Table 4.3.2, which shows that the universal proportion of successful falling wedges is less than half, as in the case of the two patterns considered earlier in Sections 5.1 and 4.2.

Trend wise Analysis of Falling wedges

All the falling wedges were examined trend wise to know whether achievement of price objective is different during different trends and the results obtained there on is presented in Tables 4.3.3, 4.3.4, 4.3.5 and 4.3.6.

Trend Wise Proportion of Falling wedges

Of the 238 falling wedges, 85 are found to have occurred during the period of down trends and the rest 153 falling wedges during the period of up trends. The trend wise difference in their frequency implies that falling wedges are more frequent in up trends than in down trends. The Table 4.3.3 shows that the frequencies of FWs differ significantly in the two trends.

Table 4.3.3 Test of significance for difference between trend wise proportions of Falling wedges

Standard Error	Difference between Proportions	Difference / S.E.
0.0311	0.29	9.1990

Trend wise Probability of Successful Falling Wedges

Tables 4.3.4, 4.3.5 and 4.3.6 show that a higher proportion of falling wedges that occurred during up trends achieved their price objective on the first, second and third reversal days than that of falling wedges occurred during down trends. For these respective days, the proportions of successful falling wedges were 32.68, 43.14 and 50.33 in up trends as against 14.12, 21.18 and 23.53 in down trends. The difference is found statistically significant on all the three reversal days.

111

The probability of success is more than fifty percent (50.33) for FWs in the up trend if waited till the third reversal day. So if a falling wedge occurs during an up trend, then it is more likely to succeed than to fail. Thus FWs occurred during up trend periods have greater probability of success compared to those occurred during down trends. Also falling wedges are more frequent in up trend periods (153) than in down trend periods (85). So a signal user gets more patterns with higher success rate. These results are just opposite of the result in Section 5.2 in respect of 'probability of success' as well as 'trend wise frequency dominance'[71].

Table 4.3.4 Trend-wise and Achievement-wise Distribution of Falling wedges (First Reversal Day)

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of FWs	% of total	Number of FWs	% of total		
100% or more	12	14.12	50	32.68	0.05938	**3.12621**
75-100	12	14.12	21	13.73	0.04675	0.08388
50-75	16	18.82	29	18.95	0.05297	0.02468
25-50	33	38.82	42	27.45	0.06285	1.80958
less than 25	12	14.12	11	7.19	0.03997	1.73330
Total	**85**	**100**	**153**	**100**		

Table 4.3.5 Trend-wise and Achievement-wise Distribution of Falling wedges (Second Reversal Day)

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of FWs	% of total	Number of FWs	% of total		
100% or more	18	21.18	66	43.14	0.06465	**3.39697**
75-100	12	14.12	22	14.38	0.04734	0.05523
50-75	16	18.82	21	13.73	0.04902	1.04003
25-50	23	27.06	33	21.57	0.05738	0.95676
less than 25	16	18.82	11	7.19	0.04290	**2.71175**
Total	**85**	**100**	**153**	**100**		

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[71] Rising wedges were more successful if occurred during down trend periods but they were fewer during down trends.

Table 4.3.6 Trend-wise and Achievement-wise Distribution of Falling wedges (Third Reversal Day)

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of FWs	% of total	Number of FWs	% of total		
100% or more	20	23.53	77	50.33	0.06647	**4.03126**
75-100	12	14.12	19	12.42	0.04553	0.37322
50-75	14	16.47	18	11.76	0.04615	1.01971
25-50	19	22.35	24	15.69	0.05205	1.28086
less than 25	20	23.53	15	9.80	0.04791	**2.86477**
Total	**85**	**100**	**153**	**100**		

Poorer success rate of FWs occurred during down trend periods is also evidenced by the difference in proportions in the category of 'achievement level less than 25%'. The up trend FWs are better performing on all the reversal days, but the difference is found statistically significant only on the second reversal day (see last row of Tables 4.2.5). On the second reversal day, of the falling wedges occurred during up trend, only 7.19% ended with an achievement level less than 25% of price objective. It was worse (more FWs with low achievement) in the case of falling wedges occurred during down trends with significantly higher percentage of 18.82 achieving 'less than 25%' of their price objective[72].

Trend wise performance of Falling wedges

The Table 4.3.7 shows that on the first, second and third reversal days, the respective means of achievement of price objective were 91.49, 115.14% and 133.00% by falling wedges occurred during up trend periods. These were lower at 60.12%, 66.00% and 64.64% respectively for falling wedges occurred during down trends. The difference in achievement of price objective is found significant on all the three reversal days (the calculated values (4.2565, 4.8926 and 5.1722) were always greater than 1.96. It is better for actions made on signals from falling wedges occurred during up trends

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[72] Smaller level achievement means less successful

113

compared to the same in down trends. If one waits for reversing the position, it is better if the signal is from a falling wedge occurred during up trends.

Judging by median achievement also, falling wedges occurred during up trends are better performing.

Table 4.3.7 Trend wise performance of falling wedges

| Statistic | Reversal Day | | | | | |
| | First | | Second | | Third | |
	Down	Up	Down	Up	Down	Up
Mean	60.12	91.49	66.00	115.14	64.64	133.00
Maximum	219.57	353.57	266.67	498.30	397.44	590.63
Minimum	-39.29	3.23	-85.71	-75.00	-192.86	-83.70
Std. Deviation	44.04	69.45	56.80	98.10	79.14	124.32
Median	47.78	69.51	50.53	85.94	55.94	100.89
	Down and Up		Down and Up		Down and Up	
S.E. of Means		7.3718128		10.043044		13.217175
Difference/ S.E.		**4.2565**		**4.8926**		**5.1722**

The probability for falling wedges to be successful is more in up trends (Tables 4.3.4-4.3.6). They are better achievers if occurred during up trends (Table 4.3.7). Thus, in respect of the 'probability of success' as well as the 'achievement level', falling wedges have more favourable position and performance if they occur during up trend periods. That is, generally price rises (correction of previous fall) after the formation of a falling wedge. But the post-pattern rise is more in up trend periods compared to the same in down trend periods. That is why the achievement level of price objective was higher for falling wedges occurred during up trends. It was smaller for those in down trends (Tables 4.3.7). That is, immediate post—FW prices hesitate to rise during down trend periods. These mean that price, after falling wedge formation, goes back to its main trend irrespective of the direction. It is same as in the result in Section 4.2.

Analysis of Time Lag up to Reversal Days

Of the 238 falling wedges analysed, twenty nine had their first reversal (i.e., reaching the next highest price after breakout) on the breakout day itself. It means price took the reverse course immediately after breakout (on the day of breakout itself) in 29 out of 238 cases. For the rest 209 FWs, the period from 'breakout day' to 'the first, second and third reversal days' ranged from a single day to eighty-two days (Table 4.3.8).

On the average, it took four (4.37), thirteen (12.92) and twenty four (23.54) days respectively, after breakout, for the prices to reach the first, second and third reversal days. It shows on the average, a trader need to wait only so many days for a reversal of price after breakout of price from falling wedge patterns. The minimum periods (most optimistic) were 1, 3, and 7 days for the first, second and third reversal days[73]. The maximum periods (most pessimistic) were 27, 42 and 82 days respectively for first, second and third reversal days. In other words, he should expect a reversal within these periods after breakout. Compared to the duration in the case rising wedge patterns (Table 4.2.8), falling wedges took longer periods for the prices to reach first and second reversal days (Table 4.3.8). It means that non-linear movement of prices is quicker in the case of the former category. However the duration for the third reversal day was same for both the patterns. Median achievement of price objective is successively higher on the three reversal days.

Table 4.3.8 Reversal day-wise lag for achievement of price objective by falling wedges

Statistic	No of Days from breakout days to the Reversal Day			Percentage of P.O. Achieved on the Reversal Day		
	First	Second	Third	First	Second	Third
Mean	4.37	12.92	23.54	80.29	97.59	108.59
Median	4.00	11.00	21.00	62.28	72.42	81.31
Minimum	1.00	3.00	7.00	-39.29	-85.71	-192.86
Maximum	27.00	42.00	82.00	353.57	498.30	590.63

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[73] *Excluding the 29 falling wedges that experienced a price reversal on the same of breakout itself.*

Analysis of Significance of Volume

The study found that from the beginning of the formation of Falling wedge patterns and till they complete, the volume showed a mixed response. Since falling wedges are bullish patterns, increase in volume at breakout is essential to confirm a breakout as a valid sell signal.

There are five different, relevant price-point days in the formation of a falling wedge pattern till breakout (just as explained in Section 5.2). The volumes traded at the following five relevant points were examined.

1. The day of First Top (T1),

2. The day of Second Top (T2),

3. The day of First Bottom (B1),

4. The day of Second Bottom (B2) and

5. The day of Breakout (Br.)

The Table 4.3.9 shows that on the average, better volumes were experienced on the days of Breakout (Br.), first Top (T1) and second Bottom (B2) with the respective volume quotient being 1.1798, 1.1597 and 1.1202. Highest of the Maximum volume is with the First Top (T1) with the quotient being 7.6548, indicating that the current volume on first Top (T1) days have come to 7.6548 times of the average volume for the nine days immediately preceding T1 day. Dwindling volume (from 7.6548 at first top to 1.1202 at second bottom) during formation shows disappearing investors as price falls and increasing volume at breakout (1.1798) shows their return resulting further price rise. The breakout day has the highest average volume (1.1798) compared to other relevant days. Increase in volume is needed for, and indicative of, further price rise.

Table 4.3.9 Volume Quotients at different price points in Falling wedges

Price Point Day	Average	Minimum	Maximum
T1	1.1597	0.00008	7.6548
T2	0.9738	0.00004	4.6141
B1	1.0925	0.00004	3.9510
B2	1.1202	0.00001	5.7168
Br.	1.1798	0.00005	5.3260
Grand Average	**1.1052**	**0.000044**	**5.4525**

The grand average (of average volumes quotients) during the formation times of falling wedges was greater (1.1052>1.0697) than the same for rising wedges (compare last row of Tables 4.3.9 and 4.2.9). If the formation of a falling wedge is a technical correction of an earlier rally, it is reasonable to accept that volume is likely to rise at the end of this pattern as the market expects that the main up trend would continue.

Upward corrections were not much extensive and that is why performance of falling wedges during down trend periods was inferior. This also supports the impact of trend in the price behaviour.

In other words, higher volume at breakout implies return of participants to the market as the main trend resumed. These mean that price, after forming a falling wedge, goes back to its main trend irrespective of the direction.

In, at least, fifty percent of the 238 Falling wedge formations, downward reversal after the 'breakout rise' has happened within four trading days (see median time lag till first reversal day in Table 4.3.8). It means decline within short duration. This, together with the findings from Tables 4.3.4-4.3.7 (higher achievement during up trends

periods and lower achievement during down trends periods), leads one to conclude and confirm the favouritism of 'the price behaviour following a falling wedge pattern' to be with the main trend.

Relationship between Demand & Supply forces and achievement of price objective

The five different candles used in this section to evaluate the relationship between the demand and supply forces and the achievement of price objectives are exactly the same as used in Sections 5.1 and 4.2. The relationship is tabulated trend wise and combined form.

Trend wise and Combined Relationship

The tables 4.3.10, 4.3.11 and 4.3.12 depict the trend-wise simple correlation co-efficient between 'achievement of price objective' and the 'occurrence of different types of candles' with their respective probable error values, on the first, second and third reversal days respectively. These tables show that the relationship is very small. It is also not significant as 'probable error of co-efficient of correlation' is too large to compare with the 'co-efficient of correlation' itself. This is true on all the reversal days, in both the trends and in the combined result. Most often the relationship is negative. The achievement of price objective is found positively correlated only in the following instances *(shown in bold figures in the table):*

1. with white candles during down trends on all the reversal days while black candles only on the second and third reversal days. White candles show demand balance and hence positive relation with 'achievement of price objective by falling wedge' is the natural consequence.

118

2. with the two types of Doji lines inside FWs occurred during up trends on the second and third reversal days. In the combined result also the same is true on the second and third reversal day.

3. with white candles inside FWs occurred during uptrends on the first reversal day.

4. inverted T type Doji lines (⊥) in down trends on the first and second reversal days.

Table 4.3.10 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement by FWs and the respective Probable Error values on the First Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.1681	0.6726667	**0.0491**	0.6742865	-0.1021	0.673954202
Black	-0.3044	0.6684845	-0.1691	0.6719686	-0.2686	0.670721827
Doji +	-0.1021	0.6738236	-0.1897	0.6713131	-0.1301	0.673614103
Doji T	-0.1099	0.6737167	-0.0604	0.6741773	-0.0792	0.674171313
Doji line ⊥ (Inverted T)	-0.0207	0.6744721	**0.0502**	0.6742766	**0.0283**	0.674458146

Table 4.3.11 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement by FWs and the respective Probable Error values on the Second Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0397	0.6743979	**0.0810**	0.6739183	-0.0126	0.674491639
Black	-0.1729	0.6725595	**0.0582**	0.6741997	-0.1297	0.673619013
Doji +	-0.0608	0.6742598	-0.1847	0.6714797	-0.0977	0.674000419
Doji line T	**0.0270**	0.6744528	-0.0265	0.6744378	**0.0271**	0.674461611
Doji line ⊥ (Inverted T)	**0.0430**	0.6743802	**0.0232**	0.6744524	**0.0604**	0.674309009

Table 4.3.12 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement by FWs and the respective Probable Error values on the Second Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0693	0.674188	**0.0595**	0.6741861	-0.0498	0.674370153
Black	-0.1282	0.673433	**0.0199**	0.674465	-0.1177	0.67377516
Doji +	-0.0380	0.674406	-0.2148	0.6704142	-0.0752	0.674204039
Doji line T	**0.0137**	0.6744879	-0.0378	0.6743736	**0.0206**	0.674477744
Doji line ⊥ (Inverted T)	**0.0253**	0.6744584	-0.0391	0.6743646	**0.0357**	0.674433146

119

In short, 'Demand and supply forces (as reflected by candles) within falling wedge patterns' and 'achievement of price objective' are independent. Since the co-efficient of correlation is very small and also insignificant, one cannot rely on it. This is true in all cases. This is true in both the trends and in the combined situation.

Summary of Results

The frequency of occurrence implies that 'the nature of the pattern 'falling wedge to reoccur' continues to be valid in the stock charts of Indian companies. As there were only ten companies analysed, one may expect, on the average, twenty four (23.8) falling wedges per stock during the period of fourteen years. The rarity of this pattern also hints abouts the limited trading opportunities.

The probability of successful falling wedges in the traditional way is less than fifty percent. The minority of successful falling wedges means that the traditional holding with respect to the price behaviour after the occurrence of this pattern is not correct. Thus the traditional holding with respect to the price behaviour after the occurrence of this pattern is not correct and so price behaviour in the traditional view after the occurrence of a falling wedge pattern is not applicable in Indian stock market. The test in Table 4.3.2 rejects the hypothesis that 'falling wedges achieve their traditionally held price objective'. Hence, they do not have predictive capacity at least in the traditional view and in this respect.

Practically and theoretically, falling wedge patterns lack predictive capacity. It is same as the result in Sections 5.2 and 4.3. for the other two patterns examined.

The falling wedge patterns are more frequent in up trend periods. Both the 'probability of success' and 'performance' are better if this pattern occurred during up trend periods. They are more successful if occurred during up trend periods. That is their 'frequency' and 'performance' differs across trends, like in the case of rising wedges. Influence of trend is visible in the success or failure of this pattern as prices

are found to move towards the main trend in which they occur irrespective of the direction.

Falling wedges patterns also mostly occur as continuation patterns rather than as reversal patterns. Price behaviours within or inside this pattern as reflected in candle formations are unable to independently explain the post-pattern price behaviour as occurrence of candles and success or failure of falling wedges are found little correlated.

Thus, except in respect of the trend-wise difference in performance, falling wedges are in par with symmetrical triangles and rising wedges.

Longer waiting for reversing the position is better if the signal is from a falling wedge occurred during up trends.

A falling wedge forecasts a rise in price and it fails more in down trends and worsens as the days pass[74], may be because of the pull of down trend itself. So it hints, reading with the similar results from Sections 4.1 and 4.2 to the fact that trend has its own long run impact.

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[74] The proportion of falling wedges in the category 'achievement less than 25%' shows a progressive increase on the first (14.12%), second (18.82) and third (23.13%) reversal days (fifth row of Tables 5.3.4-5.3.6).

SECTION 4.4

ANALYSIS OF HEAD AND SHOULDERS TOP (HST)

The construction and the psychological implications of this pattern are detailed in the third chapter. As in the case of 'rising wedge patterns', Head Shoulders Top patterns are also bearish patterns and sell signals are only considered valid. The signal is triggered when the price breaks the neckline from above and goes down.

Price Objective of a Head and Shoulders Top

The traditional holding in respect of Head and Shoulders Top (HST) is that if the price breaks down through the neckline, then the 'post-HST price fall' shall be at least equal to the vertical distance from the Head top to the neckline. That is, the difference between the 'highest price on the head day' and 'price on the neckline' (point) on the same day. A typical HST with its price objective is shown in Chart 4.5. Some conservative investors use a further filter, say 3% fall, may be used to confirm a sell signal and act (sell) only when the price has fallen to the extent of the filter from the breakout price. In this study, no such filter is used. The success or failure of the pattern is judged by measuring the achievement of price objective from the very breakout point itself.

If the HSTs are proved to be achieving their respective price objective, in a statistically significant manner, then they are considered as predictive tools.

122

Chart 4.5 Price Objective of Head and Shoulders Top
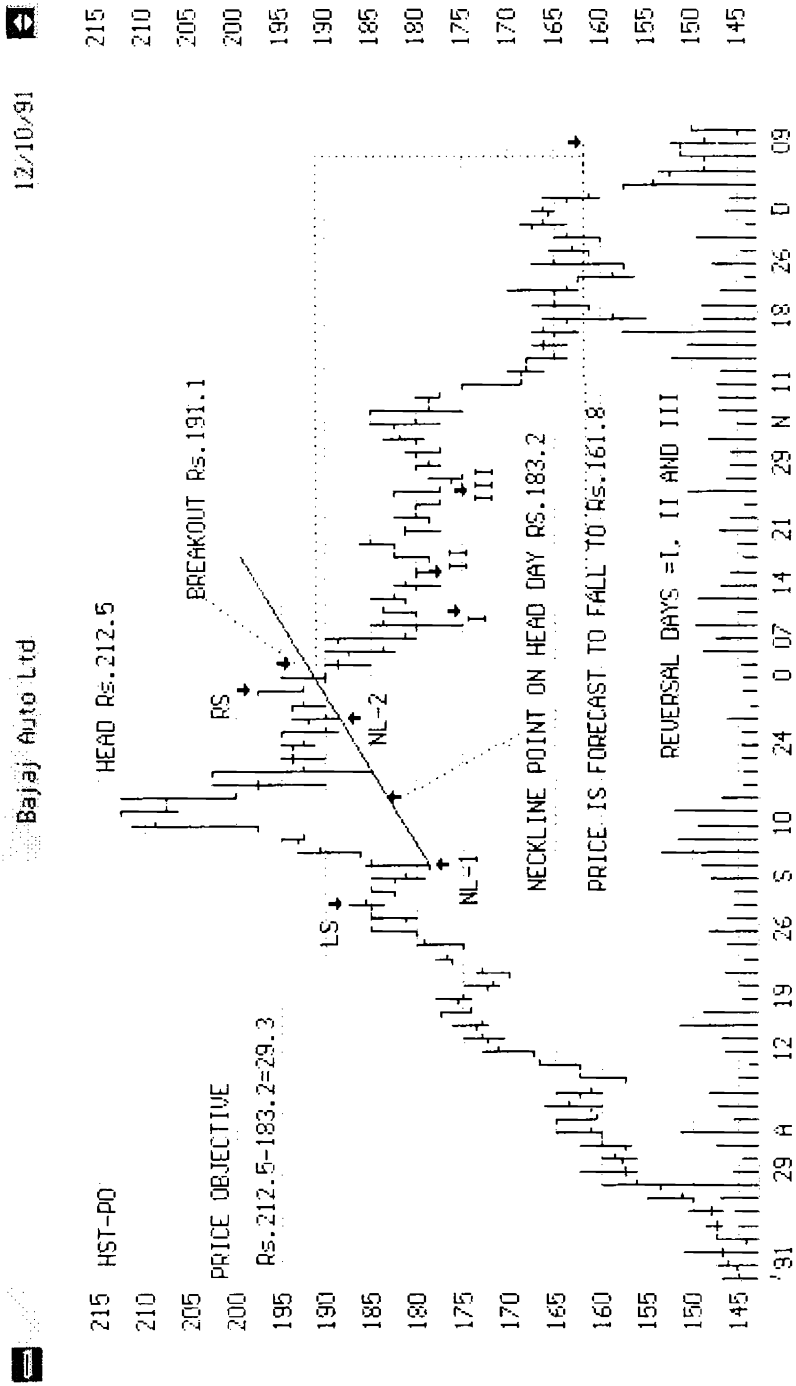
Source: BSE Data, Chart drawn by the Researcher in Metastock

Occurrence and reoccurrence of Head and Shoulders Tops

Of the 765 valid patterns found, 80 were head and shoulders top patterns. So patterns called Head and Shoulders Top patterns reoccur in stock charts of Indian companies.

The results of analysis of all the 80 valid HSTs found are presented in the following paragraphs.

The Probability of successful HSTs

A pattern is taken to be successful if it achieves its traditional price objective. The achievement wise classification and distribution of all the 80 HSTs are in Table 4.4.1. It shows that only 2.5% (a very small proportion) of the total number of HSTs could achieve their price objective in full on the first reversal day. Though the proportion rose to 7.5% on the second reversal day and to 11.25% on the third reversal day, the result is not appreciable. The 11.25% success is possible only after waiting till the third reversal day. Majority of the HSTs could not achieve even a quarter of their price objective. Of the 80 HSTs, 51.25%, 42.5% and 40.00% could achieve only less than twenty five percent of their price objective on the first, second and third reversal days respectively. Therefore, it cannot be said that HSTs have predictive capacity in this respect.

This being the observed sample values which is far less than the target, the next option is to test the result for ascertaining whether the theoretical proportion of 'successful HSTs' can ever be hundred percent. In other words, whether there is probability for all the HSTs to achieve their traditional price objective. If this probability is greater than fifty percent, that means HSTs are more probable to succeed than to fail in

signalling a sell action. The following test gives the theoretical limits (based on the observed sample values) with which the HSTs achieve various levels of price objective.

The Statistical test of significance for proportion of success gives the error in estimated proportions. Table 4.4.2 shows the various levels of achievement of price objective as revealed by the sample analysis and the probable range of proportions of HSTs in the universe (generalised for all HSTs) within 95% fiducial limits.

Table 4.4.1 Achievement-wise distribution of HST according to predictability

Percentage of PO Achieved	Reversal Day					
	First		Second		Third	
	No.	%	No.	%	No.	%
100 or more	2	2.50	6	7.50	9	11.25
75-100	4	5.00	3	3.75	6	7.50
50-75	7	8.75	12	15.00	11	13.75
25-50	26	32.50	25	31.25	22	27.50
less than 25	41	51.25	34	42.50	32	40.00
Total	**80**	**100.00**	**80**	**100.00**	**80**	**100.00**

According to the Table 4.4.2, on the first reversal day, the universal proportion of successful HSTs (that is, achieving the traditionally held level (100%) of price objective) can range from a minimum of 00.927% (i.e., 0.0092 in the table) to a maximum of just 5.92% of the total number of HSTs that occur in stock charts. The lower and upper probability values in percentage are 1.73 and 13.27 on the second reversal day and 4.33 and 18.17 on the third reversal day. So in no case, all the HSTs, found in the stock charts, achieved their traditional price objective. The best expectation possible is, even if one waits till the third reversal day, only 18.17% (less than a quarter) of the HSTs are found successful in the traditional view.

The probability of successful HSTs is always less than fifty percent (the maximum being 18.17% even on the latest reversal day considered). It means that most of the HSTs fail in their traditional predictability.

125

Table 4.4.2 The Standard Error and 95% Fiducial Limit range values of various proportions of HSTs achieving different levels of Price Objective.

P.O. Achievement	First Reversal Day			Second Reversal Day			Third Reversal Day		
	S.E	Range of proportions		S.E	Range of proportions		S.E	Range of proportions	
		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.
>=100%	1.746	-0.921	5.921	2.945	1.728	13.272	3.533	4.326	18.174
75-100%	2.437	0.224	9.776	2.124	-0.413	7.913	2.945	1.728	13.272
50-75%	3.159	2.558	14.942	3.992	7.175	22.825	3.850	6.204	21.296
25-50%	5.237	22.236	42.764	5.182	21.093	41.407	4.992	17.715	37.285
<25%	5.588	40.297	62.203	5.527	31.667	53.333	5.477	29.265	50.735

Trend wise Analysis of Head and Shoulders Tops

Though, in general, the HSTs failed to achieve the price objective all the HSTs were further examined on trend wise to know whether achievement of price objective is different during different trends and the results obtained there on is presented in Tables 4.4.3, 4.4.4, 4.4.5 and 4.4.6.

Trend Wise Proportion of Rising Wedges

Of the eighty HSTs, only ten have been found to have occurred during down trend days and the rest seventy during up trends. As stated earlier, to be valid, an HST should occur after an extensive rally. Then how it can occur in a downtrend is a question to be answered here. Even in down trends there shall be corrections in the upward direction. If these corrections are reasonably extensive but are not established up trends, then these HSTs formed at the end of these corrections are, by rule, valid but have occurred during down trend. However, the trend wise difference in their frequency implies that HSTs are more frequent in up trends than in down trends.

The Table 4.4.3 shows that the frequencies of HSTs differ significantly in the two trends as the calculated value (20.2837) is greater than 1.96.

Table 4.4.3 Test of significance for difference between trend wise proportions of HSTs

Standard Error	Difference between Proportions	Difference / S.E.
0.036976	0.75	20.2837

Trend wise probability of Successful HSTs

Tables 4.4.4, 4.4.5 and 4.4.6 show that higher proportion of HSTs that occurred during down trends achieved their full price objective on the first, second and third reversal days than that of HSTs occurred during up trends. For these respective days, the proportions of successful HSTs (in the traditional view) were 10.00, 30.00 and 40.00 in down trends as against 1.43, 4.29 and 7.14 in up trends. Thus, it is found that HSTs are more successful if they occur in downtrends than in up trends. The difference is found statistically significant on the second and third reversal days but not on the first reversal day. However, the probability of success is less than fifty percent (40.00) in either of the trends despite waiting till the third reversal day. Therefore, if an HST is formed in either of trends in a stock chart, it is more likely to fail than to succeed.

Table 4.4.4 Trend-wise and Achievement-wise Distribution of HSTs on the first reversal day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of HSTs	% of total	Number of HSTs	% of total		
100% or more	1	10.00	1	1.43	0.05278	**1.62400**
75-100	0	0.00	4	5.71	0.07368	0.77557
50-75	1	10.00	6	8.57	0.09552	0.14955
25-50	4	40.00	22	31.43	0.15834	0.54133
less than 25	4	40.00	37	52.86	0.16898	0.76088
Total	**10**	**100**	**70**	**100**		

There is also significant difference in the proportion of HSTs achieving less than 25% of their price objective in the two different trends (see the row for 'less than 25%' in Table 4.4.6) on the third reversal day.

Table 4.4.5 Trend-wise and Achievement-wise Distribution of HSTs on the Second Reversal Day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of HSTs	% of total	Number of HSTs	% of total		
100% or more	3	30.00	3	4.29	0.08904	**2.88787**
75-100	1	10.00	2	2.86	0.06423	1.11214
50-75	2	20.00	10	14.29	0.12071	0.47338
25-50	2	20.00	23	32.86	0.15670	0.82052
less than 25	2	20.00	32	45.71	0.16712	1.53869
Total	**10**	**100**	**70**	**100**		

Table 4.4.6 Trend-wise and Achievement-wise Distribution of HSTs on the third reversal day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of HSTs	% of total	Number of HSTs	% of total		
100% or more	4	40.00	5	7.14	0.10682	**3.07591**
75-100	2	20.00	4	5.71	0.08904	1.60437
50-75	2	20.00	9	12.86	0.11642	0.61354
25-50	1	10.00	21	30.00	0.15095	1.32495
less than 25	1	10.00	31	44.29	0.16562	**2.07020**
Total	**10**	**100**	**70**	**100**		

Trend wise performance of Head and Shoulders Top

The Table 4.4.7 shows that on the first, second and third reversal days, the respective means of achievement of price objective were 37.03%, 71.32% and 84.74% by HSTs occurred during down trends. These were lower at 28.93%, 27.72% and

31.07% for HSTs occurred during up trends. The difference is found significant except on the first reversal day when the calculated value (0.6991) is less than 1.96. It means longer waiting is better for actions made on signals from HSTs occurred during down trends. In other words, for immediate actions, signals from rising wedges occurred during either up or down trend are alike. Judging by median achievement also, HSTs occurred during down trends are better performing.

Table 4.4.7 Trend wise Statistics on Achievement of P.O. by HST

| Statistic | Reversal Day | | | | | |
| | First | | Second | | Third | |
	Down	up	Down	up	Down	up
Mean	37.03	28.93	71.32	27.72	84.74	31.07
Maximum	123.10	120.73	155.02	197.76	165.54	193.14
Minimum	-2.58	-0.18	0.46	-253.70	-22.52	-222.22
Std. Deviation	35.49	24.17	52.27	50.25	54.75	53.48
Median	31.40	20.24	59.61	28.76	87.43	31.84
	Up and Down		Up and Down		Up and Down	
S.E. of Means		11.587931		17.587548		18.455504
Difference/ S.E.		0.6991		2.4786		2.9083

Thus, in respect of the probability of successful pattern as well as the achievement level, HSTs have more favourable position and performance if they occur during down trend periods. However HSTs occur in down trends in fewer number (10) compared to up trends (70).

Generally, prices are expected to fall (correction of previous up move) after the formation of HSTs. But the post-pattern fall is more in down trend compared to the same in up trend periods. That is why the achievement level of price objective was higher for HSTs occurred during down trends. It was smaller for those in up trends (Tables 4.4.7). These mean that price, after HSTs formation, goes back to its main trend irrespective of the direction.

129

Thus, in respect of the proportion of successful HSTs as well as the achievement level, HSTs are more reliable and better performing if occur during down trends.

Time Lag up to Reversal Days

Of the 80 HSTs analysed, 17 HSTs had the reversal day (i.e., reaching the next lowest price) on the breakout day itself. It means price took the reverse course immediately after breakout (on the day of breakout itself) in 17 out of 80 cases. So it is a caution to the investor not to act prematurely. For the rest 63 HSTs, the period from 'breakout day' to 'third reversal day' ranged from one day to twenty one days (Table 4.4.8).

On the average, it took four (3.71), twelve (12.113) and twenty one (20.875) days respectively, after breakout, for the prices to reach the first, second and third reversal days. It shows on the average, a trader need to wait only so many days for a reversal of price after breakout of price from an HST pattern. The minimum lags (most optimistic) were 1, 2, and 6 days for the first, second and third reversal days[75]. The maximum lags (most pessimistic) were 15, 48 and 59 days respectively for first, second and third reversal days. In other words, he should expect a reversal within these periods after breakout. Median achievement of price objective is successively higher on the three reversal days (Table 4.4.8).

Table 4.4.8 Reversal Day-wise time lag for achievement of price objective by HSTs

Statistic	No of Days from breakout days to the Reversal Day			Percentage of P.O. Achieved on the Reversal Day		
	First	Second	Third	First	Second	Third
Mean	3.713	12.113	20.875	29.94	33.17	37.78
Median	2.00	9.5	17.00	22.72	33.04	35.97
Minimum	1.00	2.00	6.00	-2.58	-253.70	-222.22
Maximum	15.00	48.00	59.00	123.10	197.76	193.14

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[75] Excluding the 17 HSTs that experienced a price reversal on the same of breakout itself.

Significance of Volume

In the case of HSTs, the relevant price points differ from the other three patterns examined in Sections 5.1, 5.2 and 4.3. There are six relevant price points during the formation of an HST. They are the following:

1. The day of Left Shoulder (LS),

2. The day of First Point of the Neckline (NL1),

3. The day of Head (H),

4. The day of Second Point of the Neckline (NL2),

5. The day of Right Shoulder (RS), and

6. The day of Breakout (Br).

The first five price points are reversal price points. The volume traded at all these six relevant price points were examined and the results obtained there on are given in the following paragraphs.

The relative volume quotients were lower at the first point of neckline (NL1) and Right Shoulder (RS). On an average, the day of Head experienced highest volume followed by the day of Breakout and the day of Left Shoulder. Since HST is a bearish pattern, increase in volume at breakout is not essential to confirm a breakout as valid. However the volume quotient on the breakout day was the second highest, next only to that of the head day.

High volume shows urgency and intensity of one group of participants (informed) to get out of the market and other group (ill-informed) to get in. If HST is considered as a period of planned speculation, high volume at head (highest ever price) means many ill-informed have acquired the stock at the peak price. If breakout (here it is price fall) experiences high volume, it means supply balance is too extreme to find buyers. Pessimism leads to panic condition and further fall. So sharp fall can be the result.

131

The median fall has been to the tune of 22.72% of price objective and the median holding period (till first reversal day) was just 2 days (Table 4.4.8). These mean that within two days -a very shorter period- price fell reasonably in half of the number of HSTs studied.

The Table 4.4.9 shows that on an average, highest volume was at Head. Left shoulder day and breakout day followed it. The 'highest of the Maximum volume' and the 'highest of the Minimum volume' are also on the head day.

Table 4.4.9 Volume Quotients at different price points in HSTs

Price Point Day	Average	Minimum	Maximum
Left Shoulder	1.1913	0.0000	4.0318
Point 1 of Neckline	0.8818	0.0001	3.2494
Head	**1.4875**	**0.2762**	**4.6133**
Point 2 of Neckline	1.0880	0.0833	3.9470
Right Shoulder	0.8766	0.0001	3.3342
Breakout	1.1941	0.0465	3.8649
Grand Average	*1.1199*	*0.067706*	*3.840110*

If 'the price fall after breakout' were the beginning of worsening market sentiment and every one would try to become the first to sell out the holdings and even to go short. There fore, it is reasonable to accept that volume would rise at or near breakout. This is what is evinced by the high volume figures at breakout. The HSB volume quotients support this traditional holding

Trend wise analysis of volume

Table 4.4.10 shows the mean volume quotients (*with higher figures in bold*) at various price points within the HSTs occurred during different trends. Relatively higher volumes were found on days of the two shoulders and first point of neckline of HSTs occurred during up trends. For HSTs occurred during down trends, the days of

Head, Second Point of Neckline (NL2), Right Shoulder (RS) and Breakout had higher volume quotients. For the HSTs occurred during up trends, there were higher volume in the initial period of formation where as the volume was on the increase for HSTs occurred during down trends, except for breakout.

Table 4.4.10 Trend wise Mean Volume Quotients at Various Price Points of HST

Price Point Day	Trend		Combined
	Down	**Up**	
Left Shoulder	1.1472	**1.1976**	1.1913
NL –1	0.7574	**0.8996**	0.8818
Head	**1.4919**	1.4868	1.4875
NL-2	**1.3240**	1.0542	1.0880
Right Shoulder	0.5421	**0.9244**	0.8766
Breakout	**1.5565**	1.1423	1.1941
Average	**1.1365**	1.1175	1.1199

Relationship between Demand & Supply Forces and Achievement of Price Objective

As in the case of analysis of other patterns, five different candles such as White Candles, Black Candles, Dojis ('$+$' type), Doji lines like '$\top$' (T type) and Doji lines like '$\perp$' (inverted T type) were examined to ascertain whether there is any relationship between their preponderance in their occurrence and the achievement of price objective by Head and Shoulders Top patterns.

Trend wise and Combined Relationship

The tables 4.4.11, 4.4.12 and 4.4.13 depict the trend-wise simple correlation co-efficient between achievement of price objective and the different types of candles with their respective probable error values, on the first, second and third reversal days respectively. Positive relations-shown in bold figures-were visible only in exceptional cases and that too only with HSTs formed during up trends.

133

The tables show that most often there exists positive relationship between achievement of price objective and the number of 'Doji lines T' (T type) and 'Doji lines ⊥' (inverted T type) in all the trends. With the other three candles, the achievement is found inversely related most often. There exists a very small degree of positive correlation between the occurrence of 'T' type Dojis and achievement of price objective by the HSTs occurred in up trends. It is true on all the reversal days. On the third reversal day, 'Inverted T' type Dojis also show the same relationship. In all other cases achievement of price objective is inversely related to all types of candle formations irrespective of the trends and reversal days

On the first reversal day, positive relation, though small, is found between achievement and white candles and 'Doji lines ⊥' (inverted 'T' type) during down trends. Such relation of white candle is, however, not visible in the two trends combined. On the second reversal day the black candles are also found related in the same way. Achievement has the same relation on the third reversal day with both white candles and black candles. That also is not visible in the combined result of the third reversal day.

Table 4.4.11 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the First Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.1326	0.6734	-0.3600	0.6630	-0.1555	0.6732
Black	-0.4074	0.6637	-0.2283	0.6699	-0.3810	0.6669
Doji +	-0.2014	0.6719	-0.1669	0.6720	-0.1741	0.6729
Doji T	0.0673	0.6742	-0.3438	0.6640	-0.0049	0.6745
Doji (Inverted T)	-0.1755	0.6725	-0.4674	0.6552	-0.2349	0.6716

Table 4.4.12 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Second Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0765	0.6741	-0.5044	0.6520	-0.0963	0.6740
Black	-0.2409	0.6707	-0.5195	0.6506	-0.2861	0.6702
Doji +	-0.2073	0.6717	-0.4177	0.6590	-0.1891	0.6726
Doji T	0.0684	0.6742	-0.3016	0.6664	0.0458	0.6744
Doji (Inverted T)	-0.0151	0.6745	-0.4252	0.6585	-0.0514	0.6744

134

Table 4.4.13 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Third Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.0565	0.6743	-0.3708	0.6623	-0.0594	0.6743
Black	-0.2415	0.6707	-0.2277	0.6699	-0.2553	0.6711
Doji +	-0.1274	0.6734	-0.1375	0.6728	-0.0722	0.6742
Doji T	0.0570	0.6743	-0.3095	0.6660	0.0414	0.6744
Doji (Inverted T)	0.0159	0.6745	-0.3586	0.6631	-0.0073	0.6745

The relationship between achievement of price objective and the occurrence of different types of candles is always very little or absent. With most candles achievement is negatively correlated. However the relationship is not significant as the 'probable error of co-efficient of correlation' is always much greater than the co-efficient of correlation itself. This is true in both the trends and in the combined situation. So it may be said that candles formations within rising wedge patterns and achievement of price objective are independent.

Summary of Findings

The frequency of occurrence of HST implies that 'the nature of the pattern 'Head and Shoulders Top to reoccur' continues in the stock charts from Indian stock market. However, there were only 80 HSTs found during the period of fourteen years for ten companies. So one may expect, on the average, eight Head and Shoulders Top patterns per stock during the period of fourteen years.

The result of the test in Table 4.4.2 rejects the hypothesis that 'Head and Shoulders Top pattern achieve their price objective'. It means that most of the HSTs fail in their traditional predictability. Hence, they do not have predictive capacity at least in this respect. So the traditional holding with respect to Head Shoulders Top pattern is not valid in the Indian stock market.

Thus, in respect of the probability of successful pattern as well as the achievement level, HSTs have more favourable position and performance if they occur during down trend periods. However HSTs occur in down trends in fewer number (10) compared to up trends (70).

As in the case of other three patterns studied, practically and theoretically, majority of Head and Shoulders Top patterns do not maintain their traditional price objective and so lack predictive capacity in that sense. Therefore, the Head and shoulders top patterns are no longer a reliable traditional tool to trade with. The probability of successful HSTs in the traditional way is less than ten percent. The HST patterns are more frequent in up trend periods. But both the 'probability of success' and 'performance' are better if occurred during down trend periods. Price behaviours within or inside this pattern as reflected in candle formations are unable to independently explain the post-pattern price behaviour as occurrence of candles and success or failure of HSTs are found little correlated.

There is more risk in acting on signals from HSTs occurred during up trends. Of all the five categories of patterns, HST is the pattern with lowest level achievement of price objective. One of the probable reasons for the failure of this pattern can be its position in the stock chart. A Head and shoulders pattern occurs after an extensive rally in price. At the end of most of the rallies prices show very large fluctuations. It is at this point head is formed. So the price objective also shall be large as it is the difference between head top and the neckline point on the head day. Down trend HSTs are better performing than Up trend HSTs. It shows the dominance of trend.

SECTION 4.5

ANALYSIS OF HEAD AND SHOULDERS BOTTOM (HSB)

The construction and the psychological implications of Head and Shoulders Bottom (HSB) pattern are detailed in the third chapter. HSB is an upside down version of HST and hence has a reverse implication compared to the latter. As in the case of 'falling wedge patterns', 'Head Shoulders Bottom patterns' are also bullish patterns and give only buy signals. The signal is triggered when the price breaks the neckline from downside and goes up.

Price Objective of a Head and Shoulders Bottom Pattern

The traditional holding in respect of Head and Shoulders Bottom (HSB) is that if the price breaks up through the neckline, then the 'post-HSB price rise' shall be at least equal to the vertical distance from the Head bottom to the neckline. That is, the difference between the 'lowest price on the head day' and 'price on the neckline' (point) on the same day. A typical HSB with its price objective is shown in Chart 4.6. Some conservative investors use a further filter, say 3% rise, may be used to confirm a buy signal and act (buy) only when the price has risen to the extent of the filter from the breakout price. In this study, no such filter is used and success or failure of the pattern is judged by measuring the achievement of price objective from the very breakout point itself.

If the HSBs are proved to be achieving their price objective in full, in a statistically significant manner, then they are predictive tools. If the achievement goes short of the target, they are not having predictive capacity at least in this respect.

Chart 4.6 Price Objective of Head and Shoulders Bottom

Grasim Industri

06/06/95

PRICE IS FORECAST TO RISE TO Rs.696
=Rs.616+80

NECKLINE POINT ON HEAD DAY Rs.620

HSB-PO

NL-1

NL-2

LS

RS

PO

HEAD Rs.540

BREAKOUT Rs.616.00

PO=Rs.620-Rs.540=Rs.80

REVERSAL DAYS I, II and III

I   II   III

'95   13   23 27   A   10   24   M   08   15   22   29   J   05

690
680
670
660
650
640
630
620
610
600
590
580
570
560
550
540
530
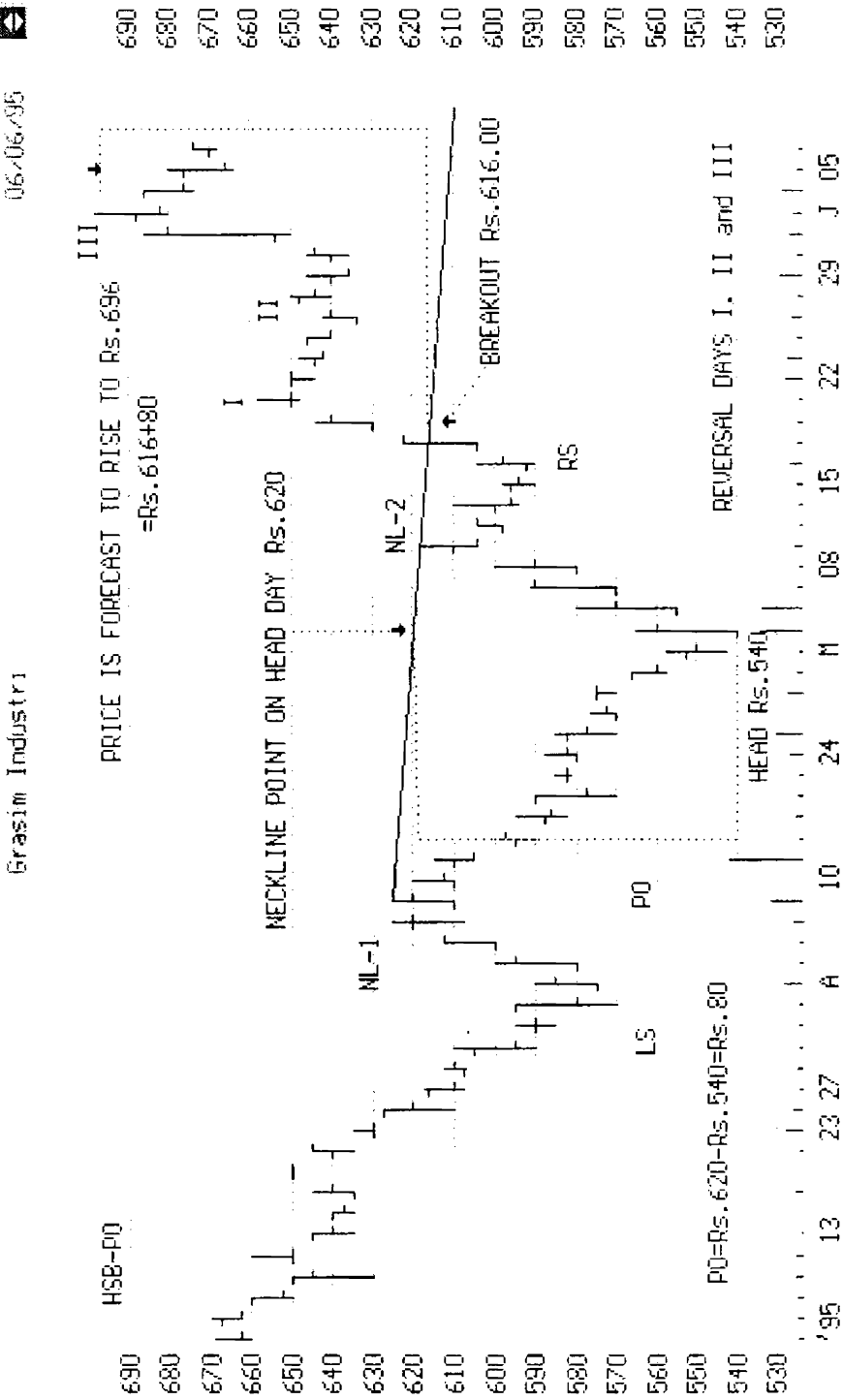
Source: BSE Data, Chart drawn by the Researcher in Metastock

Re-occurrence of Head and Shoulders Bottoms

Of the 765 valid patterns found, 63 were Head and Shoulders Bottom patterns. Their frequency of occurrence implies that 'the nature of the pattern 'Head and Shoulders Bottom to reoccur' continues to be valid in the stock charts of companies in the Indian stock market.

The Probability of successful HSBs

A pattern is taken to be successful if it achieves its traditional price objective in full. The achievement wise distribution of all the 63 HSBs are in Table 4.4.1. It shows that only 9.52% (a very small proportion) of the total number of HSBs could achieve their price objective in full on the first reversal day. Though the proportion rose 22.22% on the second reversal day and to 34.92% on the third reversal day, the result is not appreciable. The 34.92 % success is possible only after waiting till the third reversal day.

Table 4.5.1 Achievement-wise distribution of HSB according to predictability

Percentage of PO Achieved	Reversal Day					
	First		Second		Third	
	No.	%	No.	%	No.	%
100 or more	6	9.52	14	22.22	22	34.92
75-100	3	4.76	12	19.05	5	7.94
50-75	16	25.40	8	12.70	11˙	17.46
25-50	20	31.75	14	22.22	8	12.70
less than 25	18	28.57	15	23.81	17	26.98
Total	63	100.00	63	100.00	63	100.00

Majority of the HSBs could not achieve even a quarter of their price objective. Of the 63 HSBs, 28.57%, 23.81% and 26.98% could achieve only less than

twenty five percent of their price objective on the first, second and third reversal days respectively. In this respect, therefore, it cannot be said that HSBs have predictive capacity.

This being the observed sample values which is far less than the target, the next option is to test the result for ascertaining whether the theoretical proportion of 'successful HSBs' can ever be hundred percent. In other words, whether there is probability for all the HSBs to achieve their traditional price objective. If this probability is greater than fifty percent, it means HSBs are more probable to succeed than to fail in signalling a buy action. The following test gives the theoretical limits (based on the observed sample values) with which the HSBs achieve various levels of price objective.

Table 4.5.2 shows the various levels of achievement of price objective as revealed by the sample analysis and the probable range of proportions of HSBs in the universe (generalised for all HSBs) within 95% fiducial limits. On the first reversal day, the universal proportion of successful HSBs (that is, achieving the traditionally held level (100%) of price objective) can range from a minimum of 2.275 to a maximum of just 16.772% of the total number of HSBs that occur in stock charts. The lower and upper probability values in percentage are 11.956 and 32.488 on the second reversal day and 23.149 and 46.693 on the third reversal day. So in no case, all the HSBs, found in the stock charts, achieved their traditional price objective. The best expectation possible is, even if one waits till the third reversal day, only 46.693% (less than half) of the HSBs are found successful in the traditional view. Given the above standard error values, the percentage of successful HSBs reaches only 46.693% on the third reversal day at mean plus 1.96 times of standard error.

The proportion of successful HSBs means the probability of their success in the prediction in the traditional way. The probability is always less than fifty percent (the maximum being 46.693% even on the latest reversal day considered). It means that most of the HSBs fail in their traditional predictability.

Table 4.5.2 The Standard Error and 95% Fiducial Limit range values of various proportions of HSBs achieving different levels of Price Objective.

P.O. Achievement	First Reversal Day			Second Reversal Day			Third Reversal Day		
	S.E	Range of proportions		S.E	Range of proportions		S.E	Range of proportions	
		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.		P-1.96 S.E.	P+1.96 S.E.
>=100%	3.698	2.275	16.772	5.238	11.956	32.488	6.006	23.149	46.693
75-100%	2.683	-0.497	10.021	4.947	9.351	28.744	3.406	1.262	14.611
50-75%	5.484	14.648	36.145	4.195	4.477	20.920	4.783	8.086	26.835
25-50%	5.865	20.251	43.241	5.238	11.956	32.488	4.195	4.477	20.920
<25%	5.692	17.416	39.727	5.366	13.292	34.327	5.592	16.023	37.945

Trend wise Analysis of Head and Shoulders Bottoms

All the HSBs were examined trend wise to know whether the 'probability of success' and 'achievement of price objective' are different during different trends and the results obtained there on is presented in Tables 4.5.3, 4.5.4, 4.5.5 and 4.5.6.

Trend wise Proportions of HSBs

Of the sixty three HSBs, thirty one have been found occurred during down trend days and the rest thirty two during up trends. As stated earlier, to be valid, a HSB should occur after an extensive decline. Then how it can occur in an up trend is a question answered here. Even in up trends there shall be corrections in the downward direction. If these corrections are reasonably extensive but are not established down trends, then these HSBs formed at the end of these corrections are, by rule, valid but have occurred during up trend. The study found that there is little difference between the trend-wise proportions of HSBs. The Table 4.5.3 shows that there is no significant difference in the trend-wise frequencies of HSBs. The test value supports this indifference, as the calculated value (0.25008064) is less than 1.96. *It means HSBs occur more or less in same frequency in both trends.*

141

Table 4.5.3 Test of significance for difference between trend wise proportions of HSBs

Standard Error	Difference between Proportions	Difference / S.E.
0.062986143	0.02	0.252008064

Trend wise Probability of Successful HSBs

The Tables 4.5.4, 4.5.5 and 4.5.6 show that there is no significant difference in the proportions of HSBs achieving various levels of the price objective. Significant difference was not visible in any class of the achievement levels. It was true on the all the three reversal days also. All the calculated test values (last column) are less than 1.96. Compared to other patterns in this respect, this type of pattern is an exception for their indifference towards either trend.

Table 4.5.4 Trend-wise and Achievement-wise Distribution of HSBs on the First Reversal Day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of HSBs	% of total	Number of HSBs	% of total		
100% or more	3	9.68	3	9.38	0.073975	0.040881
75-100	0	0.00	3	9.38	0.053667	1.746872
50-75	9	29.03	7	21.88	0.109694	0.652475
25-50	10	32.26	10	31.25	0.117307	0.085934
less than 25	9	29.03	9	28.13	0.113846	0.079692
Total	31	100.00	32	100.00		

Table 4.5.5 Trend-wise and Achievement-wise Distribution of HSBs on the Second Reversal Day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of HSBs	% of total	Number of HSBs	% of total		
100% or more	5	16.13	9	28.13	0.10477	1.144984
75-100	6	19.35	6	18.75	0.098958	0.061121
50-75	4	12.90	4	12.50	0.083907	0.048056
25-50	8	25.81	6	18.75	0.10477	0.67352
less than 25	8	25.81	7	21.88	0.107335	0.36628
Total	31	100.00	32	100.00		

Table 4.5.6 Trend-wise and Achievement-wise Distribution of HSBs on the Third Reversal Day

% of P.O. achieved	Down Trend		Up Trend		S.E	Difference/S.E.
	Number of HSBs	*% of total*	Number of HSBs	*% of total*		
100% or more	9	19.35	13	40.63	0.120137	0.964959
75-100	3	9.68	2	6.25	0.06812	0.503146
50-75	6	32.26	5	15.63	0.095669	0.389869
25-50	3	100.00	5	15.63	0.083907	0.708827
less than 25	10	85.03	7	21.88	0.111861	0.928214
Total	31	351.52	32	100.00		

Thus, it is found that HSBs succeed or fail in up trend and down trend alike. HSBs occur in the two different trends with almost the same frequency. So it is a trend-free pattern. All the other patterns studied were more frequent in up trends.

Table 4.5.7 Trend wise Statistics on Achievement of P.O. by HSB

Statistic	Reversal Day					
	First		Second		Third	
	Down	up	Down	up	Down	up
Mean	48.88	46.20	67.54	76.93	74.69	95.05
Maximum	336.47	146.97	320.00	302.82	287.06	351.52
Minimum	-72.18	-11.54	-71.15	· -44.97	-75.25	-25.44
Std. Deviation	63.55	38.78	73.97	72.86	78.83	92.48
Median	46.53	39.24	49.02	67.11	52.59	63.98
	Up and Down		Up and Down		Up and Down	
S.E. of Means		13.31425		18.50449		21.62692
Difference/ S.E.		0.20161		0.507083		0.94147

Trend-wise performance of Head and Shoulders Bottom

The judgement based on mean and its standard error of achievement of price objective as given in the Table 4.5.7 is that HSBs do not favour either trend in achieving their price objective.

The calculated value of test of significance for difference between the two means (of achievement in the two trends) on any of the reversal day is not large enough to support that there is significant difference in the performance of HSBs in the two different trends. This true on all the three reversal days.

Thus, in respect of the 'probability of occurrence', 'probability of successful HSBs' and 'average achievement' HSBs occurred in either trend have the same result and implication as those occurred during the other trend. There is little trend-wise difference in these three respects and that too on all the three reversal days.

Time Lag up to Reversal Days

Of the 63 HSBs analysed, 8 had the first reversal day (i.e., reaching the immediate highest top price) on the breakout day itself. It means price took the reverse course immediately after breakout in 8 out of 63 cases.

The average time lag till the first, second and third reversal days were three (3.41), eleven (10.68) and twenty one (21.46) days respectively (Table 4.5.8). It shows on the average, one needs to wait only so many days for a reversal of the price after breaking the neckline. In other words, one should expect a reversal within these periods after breakout. The minimum lags (most optimistic) were 1, 3, and 7 days for the first, second and third reversal days respectively[76].

The maximum lags (most pessimistic) were 13, 24 and 59 days respectively for first, second and third reversal days.

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[76] Excluding the 8 HSBs that experienced a price reversal on the same of breakout itself

Table 4.4.8 Reversal Day-wise time lag for achievement of price objective by HSBs

Statistic	No. Of Days from Breakout till the Reversal Day			Percentage of P.O. Achieved on the Reversal Day		
	First	Second	Third	First	Second	Third
Mean	3.41	10.68	21.46	47.52	72.31	85.03
Median	3	11	17.00	44.12	56.25	60.42
Minimum	1	3	7	-72.18	-71.15	-75.25
Maximum	13	24	59	336.47	320.00	351.52

Significance of Volume

The volume traded were examined at six relevant price point days during the formation period of the HSBs. These are the same as those in Section 4.4. and listed below.

1. The day of Left Shoulder (LS),

2. The day of First Point of the Neckline (NL1),

3. The day of Head (H),

4. The day of Second Point of the Neckline (NL2),

5. The day of Right Shoulder (RS), and

6. The day of Breakout (Br).

The volume traded at all of the six price points were examined in this study.

The Table 4.5.9 depicts the volume quotients at various relevant price points during the period of HSB pattern. During the initial period of formation of HSBs (that is at LS and NL1) volume was lower. The average volume quotient at the Left Shoulder was 1.01794 and at the First Point of Neckline it was the least at 0.99185. From the formation of Head and afterwards volume was increasing. Breakout experienced the highest average volume (1.46477), followed by the Head (1.29924), the Second Point

of Neckline (1.23714) and the Right Shoulder (1.17866). Thus it is seen that as the HSB completes, volume increases and reaches maximum at breakout. Increase in volume with rise in price is a clear indication of the coming upward movement of the price. High volume shows urgency and intensity of one group of participants (informed or perceived of the ground bottom price) to accumulate stock at the cheapest price and other group (ill-informed) to get out of the market (seeing the persistent fall). If HSB is considered as a period of planned accumulation, high volume at head (lowest ever price) means many informed (early birds) have gone long at low prices. If breakout (here it is a price rise) experiences high volume, it means demand balance is too extreme to find sufficient number of sellers. Optimism adds further fuel and more participants become highly hopeful as the price has already risen from the head bottom and this situation leads to further rise in price. The median rise (on the first reversal day) has been to the tune of 44.12% of price objective and the median holding period (till the first reversal day) was just 3 days (see Table 4.5.8). These mean that within a very short period of three days, the price rose reasonably in half of the number of HSBs studied.

Table 4.5.9 Volume Quotients at different price points in HSBs

Price Point Day	Average	Minimum	Maximum
Left Shoulder	1.01794	0.00003	3.16808
Point 1 of Neckline	0.99185	**0.01919**	4.27239
Head	1.29924	0.00001	**4.87365**
Point 2 of Neckline	1.23714	0.00001	4.55834
Right Shoulder	1.17866	0.00002	3.98496
Breakout	**1.46477**	0.00008	3.98496
Grand Average	1.19827	0.00322	4.14040

The Table 4.5.9 shows that the two neckline points (NL-2 and NL-1) (the end points of the two rallies) have bagged the second rank and third rank in the maximum volume category. If rallies accompany good volume, it is an indication of

forthcoming price rise. In majority of cases (55 out of 63 HSBs), this has happened - price rose further after breakout.

If 'the price rise' after breakout is the beginning of a strengthening market sentiment and then every one would try to become the first to buy at the earliest possible competing for the best price and the resulting demand balance causes further rise in price. So it is reasonable to accept that the volume would rise at or near breakout because of improved market sentiment. The HSB volume quotients support this traditional holding.

Trend wise analysis of volume

Table 4.5.10 shows the *mean* volume quotients *(with larger figures in bold)* at various price points within the HSBs occurred during different trends. Relatively higher volumes were found on days of the Second Point of Neckline and at Breakout of HSBs occurred during up trends. At all the other price points, HSBs occurred during down trends had a lead in volume. However, as already stated, there was no trend wise difference both in respect of the proportion of successful HSBs and the average achievement level of price objective. So it may be the better volume of HSBs during down trend that caused equating their result with HSBs occurred during up trend periods.

Table 4.5.10 Trend wise Mean Volume Quotients at Various Price Points of HSB

Price Point Day	Trend		Combined ·
	Down	**Up**	
Left Shoulder	**1.1251**	0.9141	1.0179
NL -1	**1.1372**	0.8510	0.9919
Head	**1.3685**	1.2322	1.2992
NL-2	1.1260	**1.3448**	1.2371
Right Shoulder	**1.2080**	1.1502	1.1787
Breakout	1.4346	**1.4940**	**1.4648**
Average	**1.2332**	1.1644	1.1983

Relationship Between Demand & Supply Forces and Achievement of Price Objective

As in the case of analysis of other patterns, five different candles such as White Candles, Black Candles, Dojis ('$+$' type), Doji lines like '$\top$' (T type) and Doji lines like '$\perp$' (inverted T type) were examined to ascertain whether there is any relationship between their preponderance in the frequency of their occurrence and the achievement of price objective by Head and Shoulders Bottom patterns.

Trend wise and Combined Relationship

The tables 4.5.11, 4.5.12 and 4.5.13 depict the simple correlation co-efficient between achievement of price objective by HSBs and the different types of candles, on the first, second and third reversal days respectively. *Positive relations-shown in bold figures-were founding exceptional cases.*

There exists a very small degree of positive correlation between the occurrence of Dojis and achievement of price objective by the HSBs occurred in up trends on the first and the third reversal days. Doji line $\top$ (T type) are found positively related to P.O. achievement by HSbs in down trend on the second reversal day and that by HSbs in up trend on the third reversal day. On the third reversal day, Doji line '$\perp$'(Inverted T' type) also show positive relationship with P.O. achievement by HSBs occurred during up trend periods. In all other cases achievement level of price objective is inversely related to all types of candle formations irrespective of the trends and reversal days.

With White and Black candles, the achievement is found always inversely related.

148

Table 4.5.11 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the First Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.2257	0.6712	-0.0802	0.6739	-0.1094	0.6739
Black	-0.1954	0.6720	-0.3482	0.6638	-0.3032	0.6697
Doji +	**0.0643**	0.6742	-0.2076	0.6707	-0.1185	0.6738
Doji T	-0.0547	0.6743	-0.0946	0.6737	-0.0708	0.6742
Doji ⊥ (Inverted T)	-0.1889	0.6722	-0.0226	0.6745	-0.0818	0.6741

Table 4.5.12 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Second Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.2281	0.6711	-0.0742	0.6740	-0.1350	0.6735
Black	-0.2068	0.6717	-0.4036	0.6601	-0.3259	0.6689
Doji +	-0.0143	0.6745	-0.2524	0.6689	-0.1503	0.6733
Doji T	-0.1139	0.6737	**0.0667**	0.6741	-0.0315	0.6744
Doji ⊥ (Inverted T)	**0.0039**	0.6745	-0.0749	0.6740	-0.0411	0.6744

Table 4.5.13 Trend wise Co-efficient of Co-relation between Candles and P.O. Achievement and the respective Probable Error values on the Third Reversal Day

Candles	Up Trend		Down Trend		Combined	
	r	P.E.r	r	P.E.r	r	P.E.r
White	-0.1576	0.6729	-0.2173	0.6703	-0.2004	0.6724
Black	-0.1430	0.6732	-0.4919	0.6531	-0.3426	0.6684
Doji +	**0.1258**	0.6735	-0.2273	0.6699	-0.0623	0.6743
Doji T	· **0.0655**	0.6742	-0.2217	0.6701	-0.1047	0.6739
Doji ⊥ (Inverted T)	-0.0539	0.6743	-0.1302	0.6730	-0.0987	0.6740

The relationship between achievement of price objective and the occurrence of different types of candles is always very little or absent. With most candles achievement is negatively correlated. However the relationship is not significant as the 'probable error of co-efficient of correlation' is always much greater than the co-efficient of correlation itself. This is true in both the trends and in the combined situation and on all the reversal days. So it may be said that candles formations within HSB patterns and achievement of price objective by them are independent.

Summary of Results

As there were only ten companies analysed, one may expect, on the average, six HSBs per stock during the period of fourteen years. The number of patterns are very few to act upon. So it reduces trading opportunities.

As in the case of other three patterns studied, practically and theoretically, majority of Head and Shoulders Bottom patterns do not maintain their traditional price objective and so lack predictive capacity in this respect. Therefore, the Head and Shoulders Bottom patterns are no longer a reliable traditional tool to trade with. The probability of successful HSBs in the traditional way is less than thirty five percent. The test in Table 5.5.2 rejects the hypothesis that 'Head and Shoulders Bottom pattern achieve their price objective'. Hence, they do not have predictive capacity at least in this respect. The minority of successful HSBs means that the traditional holding with respect to the price behaviour after the occurrence of an HSB pattern is not correct and so price behaviour in the traditional view after signal by it is not applicable in Indian stock market.

It is found that HSBs succeed or fail in up trend and down trend alike. HSBs occur in the two different trends with almost the same frequency. So it is a trend-free pattern. All the other patterns studied were more frequent in up trends. There was also no significant trend-wise difference in the achievement level of price objective. Thus in respect of the 'probability of occurrence', 'probability of successful HSBs' and 'average achievement', HSBs occurred during either of the trends have the same result and implication as those occurred during the other. The trend-wise indifference is found on all the three reversal days. In other words, the influence of trend is not visible in the success or failure of this pattern. Price behaviours within or inside this pattern as reflected in candle formations are unable to independently explain the post-pattern price behaviour as occurrence of candles and success or failure of HSBs are found little correlated. HSBs differ from HSTs in respect of the former's indifference to trend.

CHAPTER V

ANALYSIS OF TECHNICAL INDICATORS

CHAPTER V

ANALYSIS OF TECHNICAL INDICATORS

Indicators, as stated already, indicate turning points in prices and thereby give signals to action. There are several technical indicators developed by various experts. All of them are derivations of various trading data from the market. The study evaluates the results from the use of those price indicators which have been most commonly known and widely used such as: (1) Simple Moving Average Series, (2) Moving Average Convergence Divergence (MACD) Index (3) Relative Strength Index (RSI), (4) Stochastic and (5) Rate Of Change Index (ROC).

Technique of Data Analysis.

The analysis of each indicator is made in the following manner.

1. Signal Generation

Signals are triggered when the indicator value reaches, crosses or returns to a specific amount (limit) depending upon the particular indicator considered. These limits are ascertained by trial and error so as to optimise the return. Since these limits differ for different indicators, they are mentioned in their respective part where the result is stated. Generally, trigger happens at peak-trough positions. Signals to buy and sell are strictly acted upon.

2. Selection of a Short Period and a Long Period for Indicators

Each indicator with two different periods-(1) with a short term period and (2) a long term peiod is experimented. Short Term Period Indicator and Long Term Period Indicator are expected to capture any posible benefit, if any, peculiar to 'the length of

period' for which the indicator series is computed. The number of days in these two periods are obtained through trial-and-error process so as to optimise the the result.

As a preliminary, each indicator for periods ranging from 2 days to 60 days were evaluated on two randomly selected stocks. For all the cases, the returns from terminal 'Long-Cash' and 'Long Short' combination (the best two of all choices) strategies were examined and the periods which gave the first ten best results for each indicator were averaged to obtain the period for respective indicator for the final evaluation of all the ten selected stocks. This procedure was applied for selection of the above periods for all the indicators except that for moving average in which case the preliminary examination covered the period from two days to 200 days. It was because, other indicators are more reputed to yield better result, if calculated for short periods. For every indicator the best short term period and the best long term periods were selected in this way.

3. 'In the Market' Positions Considered

Analysis of the data and the result has been drawn based on the various possible positions of an investor. A trader or investor in the market can have the following positions with respect to his commitment in the market. With respect to a certain stock, he may be 'in the market' either in a long position or in a short position, at a time. He may be 'out of the market' without any commitment (having neither any long position nor any short position). When he is not 'in the market position', he is 'out of the market position'.

An investor or trader can have ten different 'in the market' positions. Of these one is only a conceptual or theoretical position, which is never practicable in any stock market of the world[77]. The rest nine commonly practised positions are briefed here for the better comprehension of the contents of the tables.

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[77] *Indefinite short position-it is the just opposite of the buy and hold position. The short is made first and the short position is continued indefinitely for a long period. This is not allowed in any market, legally or otherwise.*

1. ***Buy-and-hold position-*** It is a non-signal strategy. In this case the investor firstly buys a stock and holds it and sells later only at the end of his investment period that is decided by him. He does not care for any analysis and there are no intervening trades. This is usually resorted by an investor-for long term.

2. ***Long-Cash Position-*** It is a signal strategy. In this study these terms refer to deals by an investor using signals from analysis. He buys the stock on the day next following the day of 'buy signal', from technical analysis. From the day of purchase to the day of sale, he holds the stock and is in 'long position'. From the day of sale to the day of next buy signal he keeps cash and is out of the market and is in cash position. That is why it is called 'Long -cash' position.

3. ***Short Cash position*** - It is a signal strategy. Here, the investor sells the security on the day next following the day of 'sell signal' from technical analysis. He buys back the stock when the next signal to buy is triggered. From the day of sale to the day of buy back, he is in short position. From the day of purchase (cover) to the day of sale, he is 'out of the market'. That is why it is called 'short-cash' position.

4. ***Long-short position-*** It is a signal strategy. In this case, the investor combines the long position and short position without any cash position. He is always 'in the market' He buys and also covers his short position, if he has any, on buy signals and on sell signals he not only sells and but also sells short. Here he expects to make profit both the ways- from the rise in price during long signal days and from the fall in prices during short signal days.

5. ***Daily long*** - It is a signal strategy where the trader first buys and then sells every day during the period from the day next following the day of 'signal to buy' to the day of 'signal to sell'. He buys at the opening price and sells at the closing

154

price of the same day. He expects a price rise for the day. For the period from the next day following the 'sell signal day' to the 'buy signal day', he is out of the market. It is a bull strategy using signals.

6. ***Daily short-*** It is a signal strategy where the trader first sells and later buys back every day during the period from the day of 'signal to sell' to the day of 'signal to buy'. It is just the opposite of the 'Daily long' strategy. He sells at the opening price and buys back at the closing price of the same day. He expects a fall in price for the day. For the period from the next day following the 'buy signal day' to the 'sell signal day', he is out of the market. It is a bear strategy using signals.

7. ***Daily long-short-*** It is a signal strategy. It is a combination of the daily short position and daily long position, without keepng any cash position. In this case the trader is always in the market. Here he expects to make profit both the ways-from the rise in price during 'buy signal days' and from the fall in prices during 'sell signal days'.

8. ***Long only-*** It is a non-signal strategy where the trader buys at opening price and sells at the closing price both on the same day. He does it every day without reference to any signal or analysis. Bulls do it. It differs from the Daily long policy as the latter uses signals from analysis.

9. ***Short only-*** It is a non-signal strategy where the trader sells at opening price and buys at the closing price both on the same day. He does it every day without reference to any signal or analysis. Bears do it. It differs from the Daily short policy as the latter uses signals from analysis

The first, eighth and ninth positions mentioned above are the three **non-signal strategies** considered in this study while the other six are signal strategies. A signal strategy uses signals from analysis[78].

4. Prices Used for Calculation

For deals in the first four (1-4) positions, the prices used are the average of the 'highest price' and the 'lowest price' on the day of trade for purchase and sale as the case may be. For deals in the next five (5-9) positions, the 'opening price' and 'closing price' of the day of trade are used. If a stock is purchased at the opening price, the same is sold at the closing price in the case of all 'Daily Long-Cash' and 'Daily Long Only' deals. For all 'Daily Short-Cash' and 'Daily Short Only' deals, sale is made at the opening price, which is covered at the closing price of the same day. 'Daily long-short is a combination of 'daily long-cash' and 'daily short-cash'. In these five cases, there is no position –short or long- on any day for being carryied forward to the next day as they are all daily deals. All deals other than daily deals are terminal as they have holding period beyond the day of entry in the market.

The present study compares the benefits for the investor-trader from being in each of these nine different positions.

The positions –short or long- with some holding period -of a day or more- are termed as *'Terminal'* deals. If positions are closed every day, that is, without any holding period or carry forward, such deals are termed as *'Daily'* deals. In this respect the first four of the above nine positions are 'Terminal deals' and the next five are 'Daily deals'. Thus there are **four** *'Terminal deals'* and **five** *'Daily deals'* depending on the type of position.

For all the terminal deals, purchases and sales are assumed to be effected 'only on the day immediately following the day of signal'. For all the Daily deals,

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[78] Signals from technical indicators in this study

trades will be effected on all the days succeeding the signal day till, and including, the day of opposite signal.

All the buy and sell signals from the indicators are strictly followed.

5. Calculation of Rate of Return (r) for each completed deal

The rate of return would reveal the return on investment per a 'two-way transaction'. Two way transaction means a completed 'in the market' position which may be 'buy first and then sell (liquidation of a long position), or sell first and then buy back or cover (covering of a short position). The calculation of return in these two positions differs slightly, as actually experienced by an investor, and hence they are summarised in the following equations.

For long positions, the return on investment is calculated by the following formula:

$$r = .995s\text{-}1.005b/1.005b$$

Where,   r =Rate of Return,   s =Selling Rate,   b =Buying Rate

0.995s means proceeds net of half a percent commission (sale price minus commission)

1.005b means purchase cost including half a percent commission (Buy rate plus commission)

For example if a stock is purchased at Rs.100 and sold at Rs.120, the rate of return shall be 18.806% (=[119.40-100.50]/100.50) when half a percentage commission is assumed at both ends. In other words, it is obtained by dividing the 'net return' by the 'cost of purchase', as shown below. Net proceeds minus cost of purchase gives net return.

[120-(120*5/100)) - (100+(100*5/100))] / (100+(100*5/100))

Net proceeds   Cost of Purchase

157

For Short positions, the return on investment is calculated by the following formula:

$$r = .995s - 1.005b / 1.005s$$

Where,   r = Rate of Return,   s = Selling Rate ,   b = Buying Rate

0.995s means proceeds net of half a percent commission (sale price minus commission).

1.005b means purchase cost including half a percent commission (Buy rate plus commission)

1.005s means the total cost of commitment for taking a short position and hence is the sell rate plus half a percentage commission.

The change in equation is necessary to reflect the reality in the market as may be understood from the following.

In the case of short deals, rate of return is obtained by dividing the 'net return' by the 'cost of Commitment'. 'Net proceeds' minus 'cost of purchase' gives the 'net return'. If there were no commission, the cost of Commitment would be equal to the selling price. When there is half a percentage commission, the cost of Commitment shall be 'selling price plus half a percentage commission'[79]. Cost of Commitment is the total liability assumed on a short deal.

For example, if a stock is first sold at Rs.120/- and bought back at Rs.100, the rate of return shall be 15.6716% if half a percentage commission is assumed at both ends (=[119.40-100.50]/120.60), computed as follows.

$$[120-(120*5/100)) - (100+(100*5/100)] \ / \ (120+(120*5/100))$$

$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$

Net proceeds   Cost of purchase   Cost of Commitment

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[79] 'Sale value' plus 'half a percentage commission on sale value' is the total liability taken on a short deal. When there is commission, selling price should be further increased by the commission to obtain the true cost of commitment.

If there were no commission at all, the seller would get the whole Rs.120/, which is the selling price. When there is half a percentage commission, the seller would get only Rs.119.4/- (i.e., Rs.120 minus half a percentage commission on Rs.120/.), given the selling price is Rs.120/-.

For Long-Short combination positions, the return on investment is calculated by sequential merging of both the returns as obtained by the above two formulae. So whenever a buy signal appears, the stock is purchased and when the same is sold on next sell signal, the return there of is calculated by the first formula. At the same sell signal, in addition to the sale of the stock owned, if short sales (shorts) are also made and when that short position is covered on the next buy signal, the return thereof is calculated by the second formula.

6. Computation of Wealth

To find the changing position of wealth, the wealth at the period of origin, which is assumed to be Rs.100/- is compounded at the 'r' as obtained above. So for example, if the first long-cash 'r' is 13% (0.13) then the terminal wealth changes to Rs. 113/- (being Rs.100+(Rs.100*13/100). Thus the previous wealth is compounded with every 'r' (for long or short as the case may be) to obtain the next terminal wealth. It will increase if 'r' is positive and decline if 'r' is negative.

7. Computation of Quarterly Wealth

The wealth figures presented in the Tables are stock wise average of the quarterly wealth. The investment values at the end of all the quarters during the data-period are averaged to obtain the average quarterly wealth. In this respect longitudinal approach is applied in finding the wealth position. Longitudinal approach yields a more stable result than that would result from a point estimate- taking result only at any one point in time. Wealth positions on the next trading day immediately following each quarter end are averaged to obtain the quarterly average wealth. This will give the

159

average wealth position of an investor who is 'in the market' on the first day and quits this position at the first quarter end, second quarter end, third quarter end and so on up to twenty eighth quarter end. So investors are assumed to have various holding periods ranging from three months (one quarter) to seven years. Just like the investors can quit the market on any day, they can also enter the market on any day. So their entry on each quarter beginning is also assumed. Therefore their wealth position would depend upon the entry date as well as their exit date. To accommodate this practical genuine experience in the market, wealth positions from quarter to quarter are found and averaged for the final figure to judge the result.

It is this average wealth that is presented in this report. These averages are found separately for the experimental period and testing period. The average of quarterly wealth is found out for all the nine different strategies that are considered in this study.

8. Calculation of Geometric Mean (GM) Return

Geometric Mean return is an annual return and calculated only as an additional evidence to confirm the result obtained by finding the quarterly wealth. If both disagree, the result by wealth is more reliable and stable as it is based on longitudinal approach where as GM is a point estimate. GM is applied here only for the comparison of result at the end point of the holding period of seven years. That is to know the annual growth, given 'initial investment' and 'value of investment' at the end of seven years. Therore, while calculating the mean return, the initial investment is taken as the Present Value (PV) and the value of investment on the last day of the study period is taken as the Future Value (FV) and the period of investment ('n') is seven years[80].

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[80] GM return = (Antilog of ((logFV-LogPV)/n))-1 or $^n\sqrt{(FV/PV)}$-1

160

9. Ascertaining Superior Strategy

The study examines whether any of the signal strategies (using any of the selected indicators) out-performs any of the non-signal strategies and whether any such superiority, if any, of either strategy is consistent. The superiority is evidenced and established by a higher 'quarterly wealth' or by a higher 'Geometric mean return'.

/10. Ascertaining Consistency of Superiority

An indicator, to be usable, should result in a return or wealth higher than that obtained without it. Besides this, such superiority should not be casual rather it should be an established one through replication indicating consistency thereof. For confirming consistency, the result obtained by examining the data during the first seven years (beginning with 1st January 1990) is re-tested in the next seven years (beginning with 1st January 1997). So the first half of the analysis period is the 'experimental period' and the next half is the 'testing period'. In the experimental period, the optimum possible 'rate of return' and 'quarterly wealth' are found out. These two values are tested for their consistency in the Testing period. If such superiority, if any, is consistent, the 'testing period return' and 'testing period quarterly wealth' should not be different from the same obtained during the experimental period. These two variables of the testing period should not be less than, at least statistically, the same from the experimental period. In other words, replication should yield the same result so as to support the previous result.

11. Statistical test of significance.

The statistical test of significance for difference between means is used to confirm the consistency of the experimental period result in continuing its validity

during testing period also[81]. The statistical tests of significance for the 'difference between the means of the returns of the two periods' and for the 'difference between means of the wealth for the two periods' for each indicator are done and they are presented in separate tables. If the results do not significantly differ, it can be presumed that the indicator performs in the two periods alike and that the same will continue. So it is not only the superior performance but the consistency thereof is also examined.

12. Presentation of results

The results are presented in the following five separate parts, each dealing with one indicator.

Part-I **Simple Moving Average**

Part-II **Moving Average Convergence Divergence (MACD) Index**

Part-III **Relative Strength Index (RSI)**

Part-IV **Stochastic and**

Part-V **Rate Of Change Index (ROC)**

In each part, the *first four* tables present the results of experimental period, *next four* tables present the results of testing period and the *last four* tables present the statistical test of significance for difference between experimental period result and testing period result. Since the results cover many pages, narration is not made on all the possible positions. However, the best result from signal strategies and the best result from non-signal strategies only are compared for illustrative purpose. Wealth figures are in rupees while GM is in decimal fractions.

The tables are self-explanatory. In each table, the stock-wise and strategy-wise summary results only are presented. The strategy corresponding to the higher

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[81] Equation mentioned in the first Chapter

figure in a column-wise comparison is the better performer. The row-wise comparison of the contents of the first eight tables in respect of each indicator (part) would reveal the superior performance of individual stock compared to other stocks. If the value obtained in the last row of the next four tables, in each part, is higher than 1.96, it shows that the results of experimental and testing periods significantly differs defeating consistency.

PART-I

RESULTS FROM MOVING AVERAGE[82]

The following two simple moving average series are evaluated to ascertain their superior performance over the non-signal strategies[83].

1. Forty three Day Moving Average (43DMA) – The period of 43 days was found to give the best result when moving average series for the period from 2 days to 200 days were applied to two stocks randomly selected from the ten stocks taken for detailed analysis.

2. Fifteen Day Moving Average (15DMA)- Fortythree days amounts to more than eight weeks' trading. Since it was felt as a reasonably long period where as market practitioners are reported and reputed to be using moving averages of short periods the study attempted also with a short period moving average for which the same sampling process, but for 2 to 25 days, as applied above was done. In this trial, the period of fifteen days was found the best.

The trigger for action by using signals from moving average is obtained in the following way:

- For BUY when the current closing price crosses over the 43 DMA from below and moves above it.

- For SELL when the current closing price crosses over the 43 DMA from above and moves below it.

The Tables 5.1 to 5.4 depicts the Mean returns and quarterly wealth for the experimental period; Tables 5.5 to 5.8 present the same for testing period and Tables 5.9-5.12 show the test of significance for difference between the means of the returns

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[82] Calculation of moving average is explained in Chapter III
[83] These two periods are obtained by trial and error optimisation.

and the difference between the means of the wealths of the two periods-experimental period and testing period.

In Table 5.1, the Buy and Hold strategy generates an average return of 18.010% where as the best signal strategy-long cash- brings only 2.416%. All the other signal strategies ended with negative average returns (Short-Cash with −18.2697%, Long-Short-with -15.765%, Daily Long Cash with -34.350%, Daily Short Cash with -73.735% and Daily Long-Short combination with –67.3556%). The Daily 'Long Only' and 'Short Only' non-signal strategies were also had negative return.

The Buy and hold's superiority does not change when judged by average wealth also. When buy and hold brought the average quarterly wealth to Rs.108.455/-, the best signal strategy could grow it only to Rs.102.105/- (Table 5.2). All the other average quarterly wealth values are lower than these two. It is the result from 15DMA.The performance of individual stocks was also not an exception. It is the result from 15DMA.

The abysmally poorer performance of signal strategy may be because of too many signals generated by the MA series as its period was short and consequent transaction cost.

Judgement by quarterly average wealth is giving more stable result as it is based on longitudinal approach where as the 'return concept is more vulnerable to sampling fluctuations as it is a single point estimate.

For 43DMA, the wealth position favours Buy and Hold as its average quarterly wealth is the highest. It is because the best signal strategy- 'long-short combination' gives a wealth of only Rs. 108.043 (Table 5.4). However, when judged by average return, this signal strategy yields 25.714%. which is much above 18.101%

obtained from the buy and hold (Table 5.3). These are the result during experimental period. When signals from 43 DMA were used, all the stocks, except stocks with serial numbers six and nine, performed better than 'buy and hold' or any other non-signal strategy. For stock with serial number 2, the mean return went up to 48.69% compared to its 'buy and hold return of 37.57%. Thus it may be said that moving averages can result in better return. A few stocks maintain their superiority when judged by wealth also (Table 5.4).

In respect of the performance of individual stocks, either or both of the 'long cash' and 'long-short' signal straegies, using 43DMA signals, have outperformed 'buy and hold policy' in nine out of the ten stocks.

During testing period, Buy and Hold dominates always when judged by average return as well as average wealth. It is true for both the 15DMA and 43DMA (Tables 5.5-5.8).

The tables 5.9-5.12 shows that the test period return and wealth are not consistent in three (Table 5.9), all the six (Table 5.11) and five (Table 5.12) of the six signal strategies with that of experimental period. In Table 5.10, the inferior wealth position of experimental period is confirmed consistent in testing period also.

There is solid evidence that Daily non-signal strategies –Long Only and Short only- are worse than the Daily signal strategies such as Daily 'Long Cash', Daily 'Short Cash' and Daily 'Long-Short' combination. That means, it isbetter not to be a 'every day Bear' or 'every day Bull'. Superior performance of some of the individual stocks implies that suitability of moving average series differs across stocks. These mean that appropriate moving average series can give some useful information regarding future prices. But what is not found is its consistency.

The result of the two non-signal daily strategies (Long only and Short ony) gives another conclusion that the open-close price difference cannot be profitably used everyday. One cause for this can be transaction cost exceeding the spread.

Table 5.1 Geometric Mean Return from 15 Day MA

From wealth at the end of Seven years (Trigger Closing price cross over)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.13432045	-0.1213013	-0.0032741	-0.6561742	-0.5409421	-0.6560021	-0.9032838	-0.8763949	0.19358483
2	0.17160296	-0.1644811	-0.0211036	-0.5441237	-0.7216089	-0.7194264	-0.7629957	-0.9493827	0.37568881
3	-0.2107685	-0.284093	-0.4349836	-0.3707785	-0.8746224	-0.6857625	-0.4843369	-0.9796823	-0.0027215
4	0.15207363	-0.1431547	-0.0128511	0.99539221	-0.9286551	-0.5717052	2.61123624	-0.9956692	0.21061869
5	-0.1045846	-0.2118362	-0.294266	-0.6639394	-0.6973976	-0.694714	-0.8974267	-0.8854844	0.06807256
6	-0.0528863	-0.3002291	-0.3372374	-0.5768848	-0.7257879	-0.639445	-0.8138052	-0.938927	0.26030394
7	0.01115314	-0.0416772	-0.0309889	-0.6973353	-0.6059566	-0.5763203	-0.9324542	-0.8417142	-0.0184075
8	0.08262436	-0.1159738	-0.0429317	-0.5451366	-0.7107245	-0.7897815	-0.8133248	-0.9327163	0.1845228
9	0.02748868	-0.2953231	-0.2759524	-0.6274359	-0.6897772	-0.7682922	-0.8238764	-0.9286587	0.40446144
10	0.03059473	-0.1489046	-0.1228655	0.25138157	-0.8780862	-0.6341134	0.30992605	-0.9888445	0.12492475
Average	0.02416185	-0.1826974	-0.1576455	-0.3435035	-0.7373558	-0.6735563	-0.3510341	-0.9317474	0.18010489
Standard Deviation	0.12091278	0.08741598	0.16182356	0.54659571	0.12294448	0.07305999	1.10516059	0.05091061	0.14320997

Table 5.2 Quarterly Wealth from 15 Day MA

Average across all 28 Quarters (Trigger Closing price cross over)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	105.571546	97.5988085	102.679903	78.168143	77.4192692	83.1162217	57.2405792	60.8366249	110.986731
2	106.523111	96.2284592	102.077573	74.3718805	83.3901022	73.7268562	72.6274186	48.7634772	111.966732
3	95.8906444	93.0453296	89.3650661	79.9398073	91.5387378	62.7889915	92.868689	41.2507616	103.912474
4	106.444251	98.1180691	104.808634	93.7919742	129.643301	88.2203779	186.060123	30.854415	111.63017
5	98.3464432	95.0549457	93.0795199	75.6930816	77.5082679	75.124725	58.1424335	59.3602767	104.044301
6	99.8831867	92.2895058	92.5303923	79.6742172	81.7062816	73.2005852	67.0618033	50.6648621	109.740963
7	101.637901	100.387759	102.756831	83.4157423	75.0091134	81.1017783	53.1805264	65.708836	104.708303
8	102.654368	97.4230066	99.8278441	68.1495256	82.552492	74.093139	66.7582602	51.7562715	107.62459
9	102.386376	92.0063557	93.7359089	70.0059334	78.5210561	75.4465702	65.8786187	52.4414388	112.56863
10	101.714831	97.1020779	99.0576032	86.8207997	108.850975	78.7323483	114.465231	197.204591	107.395244
Average	102.105266	95.9254317	97.9919276	79.0031105	88.6139596	76.5551593	83.4283684	65.8841555	108.457814
Standard Deviation	3.47688478	2.76628736	5.36287873	7.69182188	17.4765242	6.85268205	40.5465516	47.2017668	3.38851662

Table 5.3 Geometric Mean Return from 43 Day MA

From wealth at the end of Seven years (Trigger Closing price cross over)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.241165431	0.136538722	0.410632574	-0.516701439	-0.452108628	-0.724805605	-0.903283803	-0.876394945	0.193584829
2	0.443158595	0.0303346335	0.48695317	-0.440576386	-0.617486223	-0.795170438	-0.762995655	-0.949382737	0.375688806
3	0.083272229	0.0188577741	0.103700296	-0.04432245	-0.812060375	-0.842755674	-0.484336933	-0.97968234	-0.002721454
4	0.29677921	0.0401110343	0.348793469	2.76265656	-0.836071453	-0.454483573	2.611236239	-0.995669221	0.210618686
5	0.153337244	0.0227769212	0.179597825	-0.549040184	-0.587877897	-0.811751096	-0.8974267	-0.88548444	0.068072557
6	0.251350282	-0.036866882	0.205216899	-0.431043514	-0.592203451	-0.790121891	-0.813805189	-0.938927016	0.26030394
7	0.090085677	0.000195118	0.090298373	-0.54324678	-0.426998455	-0.75542786	-0.932454168	-0.841714172	-0.018407492
8	0.245322297	0.0159997935	0.265244883	-0.473616914	-0.658931841	-0.8098193 57	-0.813324814	-0.932716296	0.184522803
9	0.306222765	-0.077527112	0.204955086	-0.576758806	-0.527102165	-0.804610273	-0.823876438	-0.92865868	0.404461444
10	0.221611823	0.04448766	0.275958474	0.636102298	-0.811915813	-0.75160597	0.309926054	-0.988844528	0.124924746
Average	0.23323	0.019490907	0.25714	-0.017654762	-0.63227563	-0.754055174	-0.351034141	-0.931747437	0.180104887
Standard Deviation	0.107222233	0.055630131	0.128238571	1.045421622	0.147683005	0.110785026	1.105160593	0.050910606	0.143209973

Table 5.4 Quarterly Wealth from 43 Day MA

Average across all 28 Quarters (Trigger Closing price cross over)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	106.6666578	103.7549193	110.0715931	74.1898382	84.92854098	87.23409921	57.24057921	60.83662492	110.9867308
2	114.3349551	100.9283575	114.6187083	68.76929407	87.94638793	80.05355624	72.62741855	48.76347721	111.9667317
3	103.6211381	101.0354255	104.5862087	68.1964862	101.1593944	70.13726807	92.86868902	41.25076164	103.9124741
4	112.5061723	101.3097781	113.3799903	121.398044	172.8148723	78.96407057	186.0601234	30.85441505	111.6301702
5	105.1719723	101.3358022	106.1791245	66.95937688	83.39822325	81.92646765	58.14243346	59.36027674	104.0443009
6	106.9066146	99.46381711	105.791973	69.75254082	87.862240778	81.85169461	67.061803225	50.6648621	109.740963
7	103.9491061	100.9371642	104.9419861	72.13111483	83.71076775	88.36298048	53.18052636	65.70883599	104.7083032
8	106.51949	100.6572135	106.6977176	67.11791287	86.1808773	78.10503399	66.75826016	51.75627147	107.6245899
9	108.6375205	98.08547104	106.1865456	67.13486528	81.41092023	84.07703471	65.87861875	52.44143884	112.5686295
10	106.6268674	101.4112682	107.9801773	90.257891	117.2778677	81.81532199	114.4652314	197.2045909	107.3952441
Average	107.4940494	100.8919217	108.0434025	76.59073641	98.66902595	81.25275275	83.42836836	65.88415548	108.4578137
Standard Deviation	3.478767758	1.44655967	3.515135469	17.22546161	28.24771244	5.116159487	40.54655157	47.20176682	3.388516621

Table 5.5 Geometric Mean Return from 15 Day MA

From wealth at the end of Seven years (Trigger- Closing price cross over)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.11196157	-0.10137269	0.00611725	-0.78400482	-0.57925702	-0.89921921	-0.95817174	-0.86913534	0.13841116
2	-0.18766546	-0.1928061	-0.34428851	-0.68697656	-0.75941095	-0.76984957	-0.92816825	-0.91548734	0.09378595
3	-0.13128242	-0.14656155	-0.25860302	-0.81286666	-0.47858896	-0.60182363	-0.97521758	-0.78541382	0.00958252
4	-0.08611078	-0.18014378	-0.25074224	-0.73819112	-0.6679744	-0.91422234	-0.91117074	-0.90236213	0.04485155
5	0.03867405	-0.19136677	-0.16009364	-0.77985492	-0.62454571	-0.89588962	-0.94789188	-0.88305873	0.24096947
6	-0.10000139	-0.24355697	-0.31920232	-0.7953197	-0.67519668	-0.91824241	-0.94558038	-0.89040759	0.12734524
7	-0.03471187	-0.26952434	-0.29488052	-0.5110202	-0.74162598	-0.8717828	-0.77278814	-0.9480147	0.17938222
8	-0.16657105	-0.43259448	-0.52710781	-0.78313457	-0.77080449	-0.93639341	-0.92754421	-0.9230883	0.13489274
9	-0.13961327	-0.27591302	-0.37700517	-0.77365164	-0.70392555	-0.93562859	-0.94043968	-0.89601534	0.14596955
10	-0.14909336	-0.27715932	-0.38493007	-0.77138124	-0.70037531	-0.93061791	-0.9207629	-0.9103968	0.01063052
Average	-0.08367598	-0.2310999	-0.29107361	-0.74364014	-0.6701705	-0.86736695	-0.92277355	-0.89233801	0.11258209
Standard Deviation	0.09793828	0.09188091	0.14286826	0.08881095	0.08964692	0.10545101	0.05592926	0.04356664	0.07407722

Table 5.6 Quarterly Wealth from 15 Day MA

Average across all 28 Quarters (Trigger-Closing price cross over)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	104.506386	98.61582618	102.9798197	57.54661775	69.01025453	81.98237302	46.61601035	62.1210519	106.1658961
2	95.86475383	95.50647454	92.0274322	71.87600503	75.7817361	72.3276723	53.38901816	55.59067026	104.1713877
3	99.89020346	97.41263403	97.57090847	84.00538275	67.68305856	86.5133958	41.84328772	72.04212915	107.905015
4	98.14713831	95.68866005	93.83526243	55.74422647	72.86106936	76.47867418	56.27524411	56.96346878	102.5704119
5	102.5145053	96.28604867	97.81717089	57.95464786	69.75514769	79.09242791	49.39694137	60.99801472	109.2065879
6	98.72936618	94.30076437	93.25486269	54.35737671	68.35389783	76.52048702	49.66939926	59.4699752	105.429707
7	101.6999523	94.15150925	96.59623286	61.26814985	84.75252472	72.17547836	71.25125295	49.14816869	108.6790035
8	96.51948111	89.93166892	86.42862428	51.67828049	69.39844153	70.92246449	54.70603928	56.03457973	106.5845744
9	96.86477683	93.0687655	90.51679165	51.14231058	69.59785588	74.41190142	50.34714381	57.63791807	104.552628
10	98.06897159	94.5272307	91.75680108	53.39226231	70.97490159	75.02467844	55.14489639	55.96506845	103.3203335
Average	99.2805535	94.94895822	94.27839063	59.89652598	71.81688879	76.54495531	52.86392334	58.59710449	105.8585545
Standard Deviation	2.831891531	2.406095593	4.629477517	10.38334276	5.129779859	4.839436326	7.800661702	5.917717981	2.259895729

Table 5.7 Geometric Mean Return from 43 Day MA

From wealth at the end of Seven years (Trigger- Closing price cross over)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.0505636	-0.14164	-0.098238	-0.799716	-0.57438	-0.893537	-0.958172	-0.869135	0.1384112
2	0.0869407	0.0808589	0.1748296	-0.557486	-0.486958	-0.767034	-0.928168	-0.915487	0.0937859
3	0.242409	0.1848329	0.4720471	-0.677131	-0.330302	-0.793555	-0.975218	-0.785414	0.0095825
4	-0.09622	-0.206593	-0.282935	-0.714398	-0.649081	-0.903464	-0.911171	-0.902362	0.0448516
5	0.0572652	-0.203937	-0.15835	-0.784008	-0.634106	-0.915889	-0.947892	-0.883059	0.2409695
6	-0.139456	-0.256906	-0.360534	-0.792208	-0.656757	-0.919051	-0.94558	-0.890408	0.1273452
7	0.0926779	-0.112511	-0.03026	-0.485803	-0.709128	-0.848774	-0.772788	-0.948015	0.1793822
8	-0.14184	-0.361032	-0.451663	-0.773133	-0.757411	-0.934894	-0.927544	-0.923088	0.1348927
9	-0.136022	-0.238491	-0.342073	-0.761163	-0.692927	-0.920361	-0.94044	-0.896015	0.1459696
10	-0.164014	-0.24548	-0.369232	-0.786518	-0.700325	-0.930653	-0.920763	-0.910397	0.0106305
Average	**-0.014769**	**-0.15009**	**-0.144641**	**-0.713156**	**-0.619138**	**-0.882721**	**-0.922774**	**-0.892338**	**0.1125821**
Standard Deviation	**0.1385608**	**0.1652965**	**0.2881372**	**0.1091725**	**0.126794**	**0.0595259**	**0.0559293**	**0.0435666**	**0.0740772**

Table 5.8 Quarterly Wealth from 43 Day MA

Average across all 28 Quarters (Trigger-Closing price cross over)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	103.2830017	97.50264578	100.7028624	59.41930763	68.36112885	82.47026293	46.61601035	62.1210519	106.1658961
2	102.9258067	102.3840697	105.217301	70.41678794	82.37049117	85.27718659	53.38901816	55.59067026	104.1713877
3	109.8042422	104.9902703	114.6543315	69.03049479	76.92258387	92.17399514	41.84328772	72.04212915	107.905015
4	98.11688595	95.25168203	93.97624656	57.88415209	74.42695523	77.78399804	56.27524411	56.96346878	102.5704119
5	102.8685069	95.96752674	98.41405229	55.3033929	69.42235053	78.82798332	49.39694137	60.99801472	109.2065879
6	97.16987704	93.70419916	90.83956662	54.79452327	68.58130935	77.54038771	49.66939926	59.4699752	105.429707
7	105.0154409	98.05235387	103.5974477	64.06287265	85.87581523	74.49185292	71.25125295	49.14816869	108.6790035
8	97.26268042	91.68102825	88.97005367	52.39616428	70.20259858	72.33104603	54.70603928	56.03457973	106.5845744
9	96.88811183	94.09534248	91.54625521	54.42149008	70.77951417	75.39513815	50.34714381	57.63791807	104.552628
10	96.89438091	94.91385545	90.87912988	53.45745856	70.26928831	75.45939994	55.14489639	55.96506845	103.3203335
Average	101.0228935	96.85429738	97.87972468	59.11866442	73.72120353	79.17512507	52.86392334	58.59710449	105.8585545
Standard Deviation	4.431689299	4.083106793	8.229214871	6.536315465	6.145192966	5.950361232	7.800661702	5.917179812	2.259895729

Table 5.9 Test of Significance for difference between Means of Returns

From 15 Day MA

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.02416185	-0.1826974	-0.1576455	-0.3435035	-0.7373558	-0.6735563	-0.3510341	-0.9317474	0.18010489
Experimental Std. Dev.	0.12091278	0.08741598	0.16182356	0.54659571	0.12294448	0.073055999	1.10516059	0.05091061	0.14320997
Test Period Mean	-0.083676	-0.2310999	-0.2910736	-0.7436401	-0.6701705	-0.867367	-0.9227736	-0.892338	0.11258209
Test Period Std. Dev.	0.09793828	0.09188091	0.14286826	0.08881095	0.08964692	0.10545101	0.05592926	0.04356664	0.07407722
Standard Error of Means	0.04920549	0.04010443	0.06826288	0.17511546	0.04811644	0.04056806	0.34992971	0.02118948	0.05098679
Difference between Means	0.10783784	0.04840248	0.13342814	0.40013667	0.06718533	0.19381069	0.57173941	0.03940943	0.06752279
Difference/ S.E.	2.19158121	1.20691099	1.95462234	2.28498765	1.39630731	4.77742064	1.6338693	1.85985784	1.32431927

Table 5.10 Test of Significance for difference between Means of Wealths

From 15 Day MA

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	102.105266	95.9254317	97.9919276	79.0031105	88.6139596	76.5551593	83.4283684	65.8841555	108.457814
Experimental Std. Dev.	3.47688478	2.76628736	5.36287873	7.69182188	17.4765242	6.85268205	40.5465516	47.2017668	3.38851662
Test Period Mean	99.2805535	94.9489582	94.2783906	59.896526	71.8168888	76.5449553	52.8639233	58.5971045	105.858555
Test Period Std. Dev.	2.83189153	2.40609559	4.62947752	10.3833428	5.12977986	4.83943633	7.80066175	5.91717981	2.25989573
Standard Error of Means	1.41803871	1.15938094	2.24036895	4.08629332	5.75971821	2.65291152	13.0570792	15.0433368	1.28798966
Difference between Means	2.82471234	0.97647346	3.71353701	19.1065845	16.7970708	0.01020403	30.5644457	7.28705099	2.59925924
Difference/ S.E.	1.99198537	0.84223694	1.65755601	4.67577411	2.9163008	0.00384635	2.34083324	0.4844039	2.01807462

Table 5.11 Test of Significance for difference between Means of Returns

From 43 Day MA

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.23323056	0.01949091	0.2571351	-0.0176548	-0.6322756	-0.7540552	-0.3510341	-0.9317474	0.18010489
Experimental Std. Dev.	0.10722223	0.05563013	0.12823857	1.04542162	0.14768301	0.11078503	1.10516059	0.05091061	0.14320997
Test Period Mean	-0.0147695	-0.1500897	-0.1446408	-0.7131564	-0.6191376	-0.882721	-0.9227736	-0.892338	0.11258209
Test Period Std. Dev.	0.13856079	0.16529648	0.28813724	0.10917252	0.126794	0.059952588	0.05592926	0.04356664	0.07407722
Standard Error of Means	0.0554037	0.05515219	0.09973374	0.33238908	0.06155241	0.03977015	0.34992971	0.02118948	0.050098679
Difference between Means	0.24800004	0.16958059	0.40177591	0.69550165	0.01313808	0.12866586	0.57173941	0.03940943	0.06752279
Difference/ S.E.	4.47623606	3.07477526	4.02848514	2.09243232	0.21344538	3.23523666	1.6338693	1.85985784	1.32431927

Table 5.12 Test of Significance for difference between Means of Wealths

From 43 Day MA

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	107.494049	100.891922	108.043402	76.5907364	98.669026	81.2527528	84.4841755	96.2015714	108.455806
Experimental Std. Dev.	3.47876776	1.44655967	3.51513547	17.2254616	28.2477124	5.11615949	43.5427224	95.1810851	3.38643301
Test Period Mean	101.022893	96.8542974	97.8797247	59.1186644	73.7212035	79.1751251	52.8639233	58.5971045	105.858555
Test Period Std. Dev.	4.4316893	4.083106679	8.22921487	6.53631546	6.14519297	5.95036123	7.8006617	5.91717981	2.25989573
Standard Error of Means	1.781161991	1.36982831	2.82977304	5.82614751	9.14164457	2.4815698	13.9886347	30.1570091	1.28744154
Difference between Means	6.471155596	4.03762429	10.1636778	17.472072	24.9478224	2.07762768	31.6202522	37.6044669	2.59725111
Difference/ S.E.	3.63217536	2.9475404	3.59169362	2.99890656	2.72903002	0.837722315	2.26042448	1.24695612	2.01737401

Summary of Results of Moving Average

The 'period' selected for calculating moving average series influences the results. Here, 43DMA is better. The signal strategies gave results for some of the individual stocks far better than the average for all the stocks or greater than that from non-signal strategies. The 15DMA results were always inferior to buy and hold strategy. The 43DMA strategy outperformed the buy and hold strategy during the experimental period. But the result was not consistent as the buy and hold strategy out performed the 43DMA strategy during the testing period. The average wealth was always better for buy and hold strategy compared to the wealth generated by both 15DMA and 43DMA separately. So the hypothesis that "Signal strategies using *moving averages series* generates a return consistently greater than that from non-signal strategies."is rejected. So it can be concluded that the use of signals from the analysis of moving average series of past price data may yield a superior return but cannot yield a return consistently superior to that from a buy and hold strategy. The best explanation possible about a moving average series as a predictive tool is that its reliability is specific to time, individual stock the length of the series.

179

Part-II

RESULTS FROM MOVING AVERAGE
CONVERGENCE DIVERGENCE (MACD) INDEX[84]

Signals form MACD may be obtained in two ways. In the first method, signals occur whenever the MACD is moving in a direction opposite to the direction of price or a very short term moving average of prices. When price is advancing while MACD is falling, it signals a sale. When price is down trending but MACD is rising, it is a buy signal. In the second method, the cross over of a very short term moving average of MACDs by the MACD itself is taken as the signal. It is the second method that is used in this study.

The 'combinations of periods' that gave better results during experimental period are as follows[85]: Like in the case of Moving Average, the best suited periods of combinations were also found out by a sample study of two randomly selected stocks. Of the combinations of periods ranging from 12 days to 60 days, the best result obtained are applied to all the stock taken detailed ananlysis. A short period combination is also attempted as needed and done in the case of moving averages. These best two combinations found are:

1. Combination consisting of:

    1. A Long Term Moving Average (LTMA) of twenty eight (28) days,

    2. Short Term Moving Average (STMA) of twelve (12) days and

    3. A three (3) days moving average of MACD cross over of which by the MACD triggers the signal.

2 Combination consisting of:

    1. A Long Term Moving Average (LTMA) of fifty six (56) days,

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[84] The calculation of the Moving Average Convergence Divergence Index is explained in Chapter III.
[85] These two combinations are obtained by trial and error optimisation.

2. Short Term Moving Average (STMA) of twelve (12) days and

3. A three (3) days moving average of MACD cross over of which by the MACD triggers the signal.

Three day (MA) smoothing is always followed instead of a actual price series.

Both these combinations were applied to the data .

Equation for the construction of 28 Day MACD

$$MACD = (12DMA - 28DMA)$$

$$Trigger = 3DMA \ of \ MACD \ cross \ over \ of \ MACD$$

Equation for the construction of 56 Day MACD

$$MACD = (12DMA - 56DMA)$$

$$Trigger = 3DMA \ of \ MACD \ cross \ over \ of \ MACD$$

Results

The results of the analysis of the performance of the 28 day MACD and 56 day MACD are given in Tables 5.13 to 5.24.

The Tables 5.13 to 5.16 depicts the Mean returns and quarterly wealth for the experimental period; Tables 5.17 to 5.20 present the same for testing period and Tables 5.21-5.24 show the test of significance for difference between the means of the returns and the difference between the means of the wealths of the two periods-experimental period and testing period.

In Table 5.13, all strategies show negative return but the buy and hold. No exception is found for individual stocks also. The Buy and hold's superiority does not change when judged by average wealth also (Table 5.14). It is the result from 28 Day MACD.

For 56 Day MACD also, both the wealth position and return rate are upholding Buy and Hold policy (Tables 5.15 and 5.16). In the case of only two out of ten stocks, long cash strategy is better than buy and hold. When judged by wealth, superiority of signal strategy is valid not in the case of a single stock (Table 5.16). These are the result during experimental period.

During testing period the over all result was worse. The relative position of signal strategy does not change. Signal strategy using 28 Day MACD was better for none of the individual stocks compared to buy and hold (Tables 5.17 and 5.18). The result did not differ for 56 Day MACD when yardstick is 'quarterly wealth' (Table 5.20). Judging by 'mean return', there was only one stock turned as exception and performed better than buy and hold while using 56 Day MACD signals (Table 5.19). Both the average wealth and return across stocks support buy and hold policy.

Where ever the test of significance found the difference in results of experimental period and testing period as significant, there all the performance was worse during the latter period (Tables 5.21-5.24). Therefore, the hypothesis that "signal strategies using Moving Average Convergence Divergence index generates a return consistently greater than that from non-signal strategies." is rejected. Thus MACD index as technical indicator is not having any predictive capacity.

Summary of Results of MACD

Both the MACD series examined resulted in a return and wealth far inferior to buy and hold strategy during both the experimental and testing period. So it can be concluded that MACD series cannot generate a superior return or wealth or consistently superior return or wealth over a buy and hold strategy.

Table 5.13   Geometric Mean Return from 28 Day MACD

From wealth at the end of Seven years (LTMA 28, STMA 12 and Trigger 3DMA)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.18630056	-0.10494896	0.06179955	-0.63416782	-0.54556307	-0.82892015	-0.9032838	-0.87639494	0.19358483
2	0.00333393	-0.32421169	-0.32195866	-0.5296495	-0.75835717	-0.86847666	-0.76299566	-0.94938274	0.37568881
3	-0.09818355	-0.18672784	-0.26657779	-0.28630638	-0.83990061	-0.87710395	-0.48433693	-0.97968234	-0.00272145
4	-0.01117718	-0.32968667	-0.33717888	0.550000877	-0.94495614	-0.90262535	2.61123624	-0.99566922	0.21061869
5	-0.13117755	-0.25274789	-0.35077059	-0.66256022	-0.62109016	-0.84758658	-0.8974267	-0.88548444	0.06807256
6	-0.09149479	-0.36918797	-0.42690399	-0.57458285	-0.74596228	-0.88026956	-0.81380519	-0.93892702	0.26030394
7	-0.03958906	-0.10851157	-0.14380476	-0.73360366	-0.57553351	-0.87314952	-0.93245417	-0.84171417	-0.01840749
8	0.06413	-0.14575555	-0.09097286	-0.57348965	-0.72824185	-0.872758170	-0.81332481	-0.9327163	0.1845228
9	0.04374633	-0.29898515	-0.26831833	-0.60457833	-0.71499064	-0.87830634	-0.82387644	-0.92865868	0.40446144
10	-0.05930333	-0.23022188	-0.27587226	-0.00632795	-0.86039814	-0.83572576	0.30992605	-0.98884453	0.12492475
Average	-0.01334146	-0.235099852	-0.24205586	-0.40552576	-0.73349936	-0.8664922	-0.35103414	-0.93174744	0.18010489
Standard Deviation	0.0939228	0.09578326	0.14478437	0.39782997	0.12744979	0.02248649	1.10516059	0.05091061	0.14320997

Table 5.14 Quarterly Wealth from 28 Day MACD

Average across all 28 Quarters (LTMA 28, STMA 12 and Trigger 3DMA)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	107.587348	99.0657103	105.318871	65.9324656	78.6383218	83.0036055	57.2405792	60.8366249	110.986731
2	101.324096	92.3210208	93.3111479	61.7534866	84.2367093	71.0855908	72.6274186	48.7634772	111.966732
3	98.379378	96.0945658	94.6209319	61.9154549	94.4482638	65.3896534	92.868689	41.2507616	103.912474
4	102.950256	94.7847286	99.7439832	78.390359	119.632364	90.7741416	186.060123	30.854415	111.63017
5	97.8573737	93.9233342	92.3590271	64.2330966	77.3221326	79.3918877	58.1424335	59.3602767	104.044301
6	98.6925177	90.9107802	89.8121584	61.041025	81.5898693	72.3060907	67.0618033	50.6648621	109.740963
7	100.906102	98.7430474	99.1462723	61.3288179	72.5083869	81.9392022	53.1805264	65.708836	104.708303
8	102.642691	96.6025948	99.022704	60.3983129	81.1794771	72.9198742	66.7582602	51.7562715	107.62459
9	102.136648	92.1686132	93.6920044	60.0479425	79.9026481	73.6322606	65.8786187	52.4414388	112.56863
10	99.3523189	95.2337001	95.4143983	103.970266	103.161314	90.2278406	114.465231	197.204591	107.395244
Average	101.182873	94.9848095	96.2441499	67.9011227	87.2619487	78.0670147	83.4283684	65.8841555	108.457814
Standard Deviation	2.90114102	2.73820797	4.54173292	13.7847726	14.4360333	8.42799521	40.5465516	47.2017668	3.38851662

Table 5.15 Geometric Mean Return from 56 Day MACD

From wealth at the end of Seven years (LTMA 56, STMA 12 and Trigger 3DMA)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.21849673	-0.0558998	0.15038301	-0.61288006	-0.54002214	-0.81513637	-0.9032838	-0.87639494	0.19358483
2	0.1764771	-0.1762609	-0.03088981	-0.51794887	-0.75151425	-0.86551008	-0.76299566	-0.94938274	0.37568881
3	0.01803558	-0.0821462	-0.06559218	-0.25747457	-0.82923041	-0.85521523	-0.48433693	-0.97968234	-0.00272145
4	-0.11718663	-0.38674382	-0.45860925	0.59823291	-0.93725227	-0.88383188	2.61123624	-0.99566922	0.21061869
5	-0.04273926	-0.14485551	-0.18140375	-0.65084123	-0.63157675	-0.8409392	-0.8974267	-0.88548444	0.06807256
6	0.10296013	-0.1959527	-0.113316789	-0.52654061	-0.70676819	-0.84096602	-0.81380519	-0.93892702	0.26030394
7	-0.09037995	-0.12477987	-0.20388222	-0.75269322	-0.59944487	-0.8873201	-0.93245417	-0.84171417	-0.01840749
8	0.11337014	-0.08327428	0.02065504	-0.53118113	-0.72001629	-0.86332392	-0.81332481	-0.9327163	0.1845228
9	0.01815586	-0.29592727	-0.28314423	-0.58793521	-0.74854061	-0.88281765	-0.82387644	-0.92865868	0.40446144
10	-0.05578197	-0.2042751	-0.24866219	0.04182461	-0.8652936	-0.84749797	0.30992605	-0.98884453	0.12492475
Average	0.03414077	-0.17501155	-0.14143135	-0.37974374	-0.73296594	-0.85825584	-0.35103414	-0.93174744	0.18010489
Standard Deviation	0.11458964	0.10296037	0.17252316	0.41136259	0.12260412	0.0230061	1.10516059	0.05091061	0.14320997

Table 5.16 Quarterly Wealth from 56 Day MACD

Average across all 28 Quarters (LTMA 56, STMA 12 and Trigger 3DMA)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	109.112326	100.084366	108.058233	67.0844857	79.8892833	83.360602	57.2405792	60.8366249	110.986731
2	105.469519	96.0491329	100.969858	62.3525645	84.8672626	71.7583077	72.6274186	48.7634772	111.966732
3	101.361523	99.4626043	100.514043	64.4957794	95.729303	66.3431671	92.868689	41.2507616	103.912474
4	98.6560762	92.7382779	91.866194	77.192373	122.176332	88.5247666	186.060123	30.854415	111.63017
5	99.8597594	96.9812044	96.4170889	64.670815	78.3164284	78.6682904	58.1424335	59.3602767	104.044301
6	103.628287	96.2950873	100.069539	65.2985227	84.0928971	74.7723895	67.0618033	50.6648621	109.740963
7	98.547957	98.3127901	97.2687766	59.8598718	71.8199698	80.9440547	53.1805264	65.708836	104.708303
8	103.458694	98.2996486	101.337071	61.48602	83.1672507	73.566624	66.7582602	51.7562715	107.62459
9	101.596852	92.1123178	93.392218	59.682739	81.0431764	71.6918717	65.8786187	52.4414388	112.56863
10	99.7033334	95.762228	95.9386369	81.9396921	103.825164	83.0104655	114.465231	197.204591	107.395244
Average	102.139433	96.6097657	98.5831659	66.4062863	88.4927067	77.2640539	83.4283684	65.8841555	108.457814
Standard Deviation	3.34550028	2.63423203	4.64843434	7.41379095	14.8845671	6.77425425	40.5465516	47.2017668	3.38851662

Table 5.17 Geometric Mean Return from 28 Day MACD

From wealth at the end of Seven years (LTMA 28, STMA 12 and Trigger 3DMA)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.1196157	-0.10137269	0.000611725	-0.78400482	-0.57925702	-0.89921921	-0.95817174	-0.86913534	0.13841116
2	-0.08960144	-0.19391227	-0.26613889	-0.71352608	-0.70172163	-0.90854529	-0.92816825	-0.91548734	0.09378595
3	-0.12088851	-0.26681195	-0.35544596	-0.85074381	-0.52639123	-0.89534686	-0.97521758	-0.78541382	0.00958252
4	-0.08611078	-0.18014378	-0.25074224	-0.73819112	-0.6679744	-0.91422234	-0.91117074	-0.90236213	0.04485155
5	0.03867405	-0.19136677	-0.16009364	-0.77985492	-0.62454571	-0.89588962	-0.94789188	-0.88305873	0.24096947
6	-0.10000139	-0.24355697	-0.31920232	-0.7953197	-0.67519668	-0.91824241	-0.94558038	-0.89040759	0.12734524
7	-0.03471187	-0.26952434	-0.29488052	-0.5110202	-0.74162598	-0.8717828	-0.77278814	-0.9480147	0.17938222
8	-0.16657105	-0.43259448	-0.52710781	-0.78313457	-0.77080449	-0.93639341	-0.92754421	-0.9230883	0.13489274
9	-0.13961327	-0.27591302	-0.37700517	-0.77365164	-0.70392555	-0.93562859	-0.94043968	-0.89601534	0.14596955
10	-0.14909336	-0.27715932	-0.38493007	-0.77138124	-0.70037531	-0.93061791	-0.9207629	-0.9103968	0.01063052
Average	**-0.07283019**	**-0.24323556**	**-0.29294294**	**-0.75008281**	**-0.6691818**	**-0.91058884**	**-0.92277355**	**-0.89233801**	**0.11258209**
Standard Deviation	**0.0903638**	**0.08727434**	**0.14319625**	**0.09125445**	**0.074027**	**0.02069231**	**0.05592926**	**0.04356664**	**0.07407722**

Table 5.18 Quarterly Wealth from 28 Day MACD

Average across all 28 Quarters (LTMA 28, STMA 12 and Trigger 3DMA)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	104.506386	98.61582618	102.9798197	57.54661775	69.01025453	81.98237302	46.61601035	62.1210519	106.1658961
2	98.76848396	95.34784831	94.00438477	56.17379673	74.33352817	74.75673681	53.38901816	55.59067026	104.1713877
3	98.75957814	93.72041652	91.66234414	59.21719582	62.80275825	85.43976569	41.84328772	72.04212915	107.905015
4	98.14713831	95.68866005	93.83526243	55.74422647	72.86106936	76.47867418	56.27524411	56.96346878	102.5704119
5	102.5145053	96.28604867	97.81717089	57.95464786	69.75514769	79.09242791	49.39694137	60.99801472	109.2065879
6	98.72936618	94.30076437	93.25486269	54.35737671	68.35389783	76.52048702	49.66939926	59.4699752	105.429707
7	101.6999523	94.15150925	96.59623286	61.26814985	84.75252472	72.17547836	71.25125295	49.14816869	108.6790035
8	96.51948111	89.93166892	86.42862428	51.67828049	69.39844153	70.92246449	54.70603928	56.03457973	106.5845744
9	96.86477683	93.0687655	90.51679165	51.14231058	69.59785588	74.41190142	50.34714381	57.63791807	104.552628
10	98.06897159	94.5272307	91.75680108	53.39226231	70.97490159	75.02467844	55.14489639	55.96506845	103.32033335
Average	**99.45786398**	**94.56387385**	**93.88522945**	**55.84748646**	**71.18403796**	**76.68049873**	**52.86392334**	**58.59710449**	**105.8585545**
Standard Deviation	**2.589645338**	**2.258531217**	**4.50128491**	**3.265175873**	**5.652985707**	**4.4191209942**	**7.800661702**	**5.91717981**	**2.259895729**

Table 5.19 Geometric Mean Return from 56 Day MACD

From wealth at the end of Seven years (LTMA 56, STMA 12 and Trigger 3DMA)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.05056357	-0.14163991	-0.09823816	-0.79971626	-0.57437981	-0.89353662	-0.95817174	-0.86913534	0.13841116
2	-0.05790213	-0.16385798	-0.21227238	-0.69739437	-0.68223173	-0.89541374	-0.92816825	-0.91548734	0.09378595
3	0.06194682	-0.08459939	-0.02789323	-0.83327138	-0.41783467	-0.89811123	-0.97521758	-0.78541382	0.00958252
4	-0.09622016	-0.20659274	-0.28293452	-0.71439772	-0.64908065	-0.90346366	-0.91117074	-0.90236213	0.04485155
5	0.0572652	-0.20393673	-0.15835	-0.78400822	-0.63410639	-0.91588885	-0.94789188	-0.88305873	0.24096947
6	-0.13945563	-0.25690578	-0.36053445	-0.79220773	-0.65675727	-0.91905052	-0.94558038	-0.89040759	0.12734524
7	0.09267791	-0.11251073	-0.03026007	-0.48580293	-0.70912846	-0.84877431	-0.77278814	-0.9480147	0.17938222
8	-0.14183973	-0.36103156	-0.45166267	-0.77313288	-0.75741093	-0.9348937	-0.92754421	-0.9230883	0.13489274
9	-0.13602188	-0.23849146	-0.34207328	-0.76116339	-0.69292661	-0.92036119	-0.94043968	-0.89601534	0.14596955
10	-0.16401392	-0.24547971	-0.36923154	-0.78651826	-0.70032495	-0.93065306	-0.9207629	-0.9103968	0.01063052
Average	-0.0473	-0.2015046	-0.23334503	-0.74276131	-0.64741815	-0.90601469	-0.92277355	-0.89233801	0.11258209
Standard Deviation	0.10190931	0.08058093	0.15068803	0.09868479	0.09445697	0.02478309	0.05592926	0.04356664	0.07407722

Table 5.20 Quarterly Wealth from 56 Day MACD

Average across all 28 Quarters (LTMA 56, STMA 12 and Trigger 3DMA)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	103.283002	97.5026458	100.702862	59.4193076	68.3611289	82.4702629	46.6160103	62.1210519	106.165896
2	99.4683993	96.4300376	95.4477241	58.3896782	75.0466179	76.1248052	53.3890182	55.5906703	104.171388
3	104.822832	99.0905505	101.985139	58.4048386	65.2933147	88.9497115	41.8432877	72.0421291	107.905015
4	98.116886	95.251682	93.9762466	57.8841521	74.4269552	77.783998	56.2752441	56.9634688	102.570412
5	102.868507	95.9675267	98.4140523	55.3033929	69.4223505	78.8279833	49.3969414	60.9980147	109.206588
6	97.169877	93.7041992	90.8395666	54.7945233	68.5813094	77.5403877	49.6693993	59.4699752	105.429707
7	105.015441	98.0523539	103.597448	64.0628726	85.8758152	74.4918529	71.251253	49.1481687	108.679004
8	97.2626804	91.6810283	88.9700537	52.3961643	70.2025986	72.331046	54.7060393	56.0345797	106.584574
9	96.8881118	94.0953425	91.5462552	54.4214901	70.7795142	75.3951381	50.3471438	57.6379181	104.552628
10	96.8943809	94.9138555	90.8791299	53.4574586	70.2692883	75.4593999	55.1448964	55.9650685	103.320334
Average	100.179012	95.6689222	95.6358477	56.8533878	71.8258893	77.9374586	52.8639233	58.5971045	105.858555
Standard Deviation	3.42799395	2.2211882	5.23526028	3.46962998	5.69283593	4.73737174	7.8006617	5.91717981	2.25989573

Table 5.21 Test of Significance for difference between Means of Returns

Results of 28 Day MACD

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	-0.0133415	-0.2350985	-0.2420559	-0.4055258	-0.7334994	-0.8664922	-0.3510341	-0.9317474	0.18010489
Experimental Std. Dev.	0.0939228	0.09578326	0.14478437	0.39782997	0.12744979	0.02248649	1.10516059	0.05091061	0.14320997
Test Period Mean	-0.07728302	-0.2432356	-0.2929429	-0.7500828	-0.6691818	-0.9105888	-0.9227736	-0.892338	0.11258209
Test Period Std. Dev.	0.09036380	0.08727434	0.14319625	0.09125445	0.074027	0.020692310	0.05592926	0.043566664	0.07407722
Standard Error of Means	0.041215420	0.04097712	0.0643954	0.12907210	0.04660842	0.00966340	0.34992971	0.02118948	0.05098679
Difference between Means	0.059448873	0.008137040	0.05088708	0.34455705	0.064317560	0.044096640	0.57173941	0.039409430	0.06752279
Difference/ S.E.	1.443360990	0.198575230	0.79022845	2.66949295	1.37995589	4.56326118	1.6338693	1.85985784	1.32431927

Table 5.22 Test of Significance for difference between Means of Wealths

Results of 28 Day MACD

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	101.182873	94.9480095	96.2441499	67.9011227	87.2619487	78.0670147	83.4283684	65.8841555	108.457814
Experimental Std. Dev.	2.90114102	2.7382079	74.5417329	213.7847726	14.4360333	8.4279952	140.5465516	47.2017668	3.38851662
Test Period Mean	99.457864	94.5638738	93.8852295	55.8474865	71.184038	76.6804987	52.8639233	58.5971045	105.858555
Test Period Std. Dev.	2.58964534	2.5853122	4.5012849	3.2651758	75.6529857	14.41912094	7.8006617	5.91717981	2.25989573
Standard Error of Means	1.22975128	1.12244136	2.02210049	4.47974698	4.90260445	3.00931444	13.0570792	15.0433368	1.28798966
Difference between Means	1.72500901	0.42093569	2.35892041	12.0536363	16.0779107	1.38651599	30.5644457	7.28705099	2.59925924
Difference/ S.E.	1.40273	0.37501798	1.16656933	**2.69069578**	**3.27946331**	0.46074148	**2.34083324**	0.48440392	**2.01807462**

Table 5.23 Test of Significance for difference between Means of Returns

Results of 56 Day MACD

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.03414077	-0.1750115	-0.1414313	-0.3797437	-0.7329659	-0.8582558	-0.3510341	-0.9317474	0.18010489
Experimental Std. Dev.	0.11458964	0.102960037	0.17252316	0.41136259	0.12260412	0.02300061	1.10516059	0.05091061	0.14320997
Test Period Mean	-0.0473	-0.2015046	-0.233345	-0.7427613	-0.6474181	-0.9060147	-0.9227736	-0.8923338	0.11258209
Test Period Std. Dev.	0.10190931	0.08058093	0.15068803	0.09868479	0.09445697	0.02478309	0.05592926	0.04356664	0.07407722
Standard Error of Means	0.04849936	0.04134504	0.07243696	0.13377513	0.04894271	0.01069337	0.34992971	0.02118948	0.05098679
Difference between Means	0.08144077	0.02649305	0.09191369	0.36301757	0.08554779	0.04775885	0.57173941	0.03940943	0.06752279
Difference/ S.E.	1.67941271	0.64077949	1.26887837	**2.71364013**	1.7479169	**4.46620908**	1.6338693	1.85985784	1.32431927

Table 5.24 Test of Significance for difference between Means of Wealths

Results of 56 Day MACD

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	102.139433	96.6097657	98.5831659	66.4062863	88.4927067	77.2640539	83.4283684	65.8841555	108.457814
Experimental Std. Dev.	3.34550028	2.63423203	4.64843434	7.41379095	14.8845671	6.77425425	40.5465516	47.2017668	3.38851662
Test Period Mean	100.179012	95.6689222	95.6358477	56.8533878	71.8258893	77.9374586	52.8639233	58.5971045	105.858555
Test Period Std. Dev.	3.42799395	2.22118825	5.23526028	3.46962998	5.6928359	4.73737174	7.80066175	5.91717981	2.25989573
Standard Error of Means	1.51471168	1.08962633	2.2139533	2.58848659	5.0394317	2.6140622	13.0570792	15.0433368	1.28798966
Difference between Means	1.96042094	0.94084354	2.94731816	9.5528985	16.6668175	0.67340465	30.564445	7.28705099	2.59925924
Difference/ S.E.	1.294253353	0.86345522	1.33124676	3.69053428	3.30728115	0.2576085	2.34083324	0.4844039	2.01807462

Part-III

RESULTS FROM RELATIVE STRENGTH INDEX[86]

The following two RSI series are examined in this study[87].

These two periods were also selected as they were found to be the best when the preliminary study of two stocks from 2 days to 60 days were experimented, as done in the selection of period for MA and MACD. The best two in respective category of short term and long term are the following and which were taken for detailed analysis of al the stocks selected.

1. Six Day Relative Strength Index (6DRSI) and

2. Thirty six Day Relative Strength Index (36DRSI)

The results are presented in Tables 5.25-5.36

The Tables 5.25 to 5.28 depicts the Mean returns and quarterly wealth for the experimental period; Tables 5.29 to 5.32 present the same for testing period and Tables 5.33-5.36 show the test of significance for difference between the means of the returns and the difference between the means of the wealths of the two periods-experimental period and testing period.

The Trigger was to buy when RSI goes above 51.2 and sell when it cames down below 90.7. These two triggers were also obtained by trial and error method so as to get an optimum result.

In the case of four out of ten stocks, signal strategies using 6 Day RSI earned a return better than buy and hold. How ever the average return favoured buy and hold (Table 5.25). When judged by quarterly wealth, the Table 5.26 shows that though signal strategy-long cash -was better for five stocks, the 'average for all

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[86] The calculation of the Relative Strength Index is explained in Chapter III
[87] These two periods are obtained by trial and error optimisation.

195

stocks' still favoured buy and hold with a difference of Rs.1.72 (Rs.108.46-106.74).

The Table 5.27 shows that the use of 36 Day RSI managed to improve performance, while acting on its signals, for more (6) number of individual stocks but the average for all stocks became worse than that of 6 Day RSI. The number of individual stocks to which signal strategy was better came down to 2 from 6 when the performance is judged by quarterly wealth (Table 5.28).

During testing period, signal strategy was better than buy and hold, for four stock when judged by return and for two stocks when judged by wealth. However the average wealth and return for all stocks were worse during Testing Period. Of these, the result of signal strategies were stll worse than that of buy and hold policy (Tables 5.31 and 5.32).

The test of significance for difference between results (Tables 5.33-5.36) support that the inferior performance of signal strategies during experimental period continues in testing testing period also. Signal strategies for which difference was found significant are already poor performers. Therefore, the hypothesis that "Signal strategies using *Relative strength index* generates a return consistently greater than that from non-signal strategies."is rejected. Thus RSI is found as having no predictive value.

Summary of Results of RSI

The two RSI series (36 Day RSI and 6 Day RSI) could perform better than a buy and hold strategy for some of the individual stocks. This happened during both the experimental and testing periods. However, while judging by the average results for all the stocks, buy and hold strategy was better than the signal strategy using RSI signals. So it may concluded that the use of signals from the analysis of RSI series can not yield a return better than that from a buy and hold strategy.

Table 5.25 Geometric Mean Return from 6 Day RSI

From wealth at the end of Seven years (Trigger buy at 51.2 and sell at 90.7)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.20191967	-0.16857482	-0.000069373	-0.9013175	-0.13219575	-0.91655379	-0.9032838	-0.87639494	0.19358483
2	0.18033953	-0.02085329	0.15572557	-0.76337774	-0.03209885	-0.76944161	-0.76299566	-0.94938274	0.37568881
3	-0.01869962	-0.03303713	-0.05111896	-0.474999	-0.05250099	-0.50142706	-0.48433693	-0.97968234	-0.00272145
4	0.18742732	0.012224575	0.20196826	2.27122096	-0.15660575	1.74283504	2.61123624	-0.99566922	0.21061869
5	0.02873171	-0.107211	-0.08155964	-0.889312	-0.0464391	-0.89579361	-0.8974267	-0.88548444	0.06807256
6	0.12246773	-0.03986981	0.07771515	-0.80945358	-0.06847476	-0.8261296	-0.81380519	-0.93892702	0.26030394
7	0.12447445	0.01500268	0.06845576	-0.91939762	0.00020934	-0.92024428	-0.93245417	-0.84171417	-0.01840749
8	0.20951715	0.02410147	0.23866829	-0.79721173	-0.03925185	-0.8041382	-0.81332481	-0.9327163	0.1845228
9	0.39193676	-0.02119729	0.36243148	-0.81571696	-0.06742435	-0.82627889	-0.82387644	-0.92865868	0.40446144
10	0.24246523	-0.04558332	0.18582954	-0.83365945	-0.07480664	-0.84452821	0.30992605	-0.98884453	0.12492475
Average	0.16705799	-0.03849768	0.11574217	-0.49332246	-0.06677046	-0.55617002	-0.35103414	-0.93174744	0.18010489
Standard Deviation	0.11416744	0.05933891	0.13901331	0.97938919	0.04682992	0.81664301	1.10516059	0.05091061	0.14320997

Table 5.26 Mean Quarterly Wealth from 6 Day RSI

Average across all 28 Quarters (Trigger buy at RSI=51.2 and sell at RSI=90.7)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	107.73641	96.708662	103.4557	54.717787	57.596362	96.945072	57.240579	60.836625	110.98673
2	107.8282	99.510172	106.26472	71.562117	72.410017	99.2708	72.627419	48.763477	111.96673
3	100.98585	99.225421	100.41233	92.741571	93.202674	98.774356	92.868689	41.250762	103.91247
4	100.78326	98.043241	98.826499	58.260759	59.231989	98.925971	186.06012	30.854415	111.63017
5	105.20376	99.089735	103.06184	65.885172	67.476614	98.513817	58.142433	59.360277	104.0443
6	103.77597	101.05079	104.61693	53.597555	55.197511	98.33093	67.061803	50.664862	109.74096
7	107.63647	100.62426	108.2338	67.586572	68.393931	99.119986	53.180526	65.708836	104.7083
8	107.93906	100.45164	107.82678	169.00833	181.23784	97.277876	66.75826	51.756271	107.62459
9	117.32618	99.508787	117.22562	65.682367	66.676833	98.443338	65.878619	52.441439	112.56863
10	108.19975	98.948498	106.05459	64.706933	66.132893	98.311845	114.46523	197.20459	107.39524
Average	106.74149	99.31612	105.59788	76.374917	78.755666	98.391399	83.428368	65.884155	108.45781
Standard Deviation	4.6946177	1.2779392	5.082626	34.360321	37.52817	0.7524829	40.546552	47.201767	3.3885166

Table 5.27 Geometric Mean Return from 36 Day RSI

From wealth at the end of Seven years (Trigger buy at RSI=47 and sell at RSI=70)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.2517881	-0.0041983	0.2465328	-0.867907	-0.1843539	-0.8948823	-0.9032838	-0.8763949	0.1935848
2	0.2727518	-0.1075625	0.1358514	-0.6799612	-0.4019082	-0.8138686	-0.7629957	-0.9493827	0.3756888
3	0.0138204	-0.0392857	-0.0260082	-0.3594212	-0.1747549	-0.4695416	-0.4843369	-0.9796823	-0.0027215
4	0.0443127	-0.3062236	-0.2754805	1.9994831	-0.4557045	0.5777167	2.6112362	-0.9956692	0.2106187
5	0.0693834	-0.144201	-0.0848228	-0.8353536	-0.3011581	-0.8837498	-0.8974267	-0.8854844	0.0680726
6	0.2328279	-0.0414558	0.1817201	-0.7141735	-0.4188583	-0.8369304	-0.8138052	-0.938927	0.2603039
7	0.052663	0.0150027	0.0684558	-0.9193976	0.0020934	-0.9202443	-0.9324542	-0.8417142	-0.0184075
8	0.2095171	0.0241015	0.2386683	-0.7972117	-0.0392519	-0.8041382	-0.8133248	-0.9327163	0.1845228
9	0.2612056	0.0156716	0.2809708	-0.7638602	-0.1976088	-0.8096836	-0.8238764	-0.9286587	0.4044614
10	0.0709979	-0.1368814	-0.0756018	-0.7898707	-0.4848894	-0.8909022	0.3099261	-0.9888445	0.1249247
Average	0.1479268	-0.0725032	0.0690286	-0.4737674	-0.2656394	-0.6746224	-0.3510341	-0.9317474	0.1801049
Standard Deviation	0.105454	0.1036216	0.1809471	0.8790372	0.1731826	0.4583202	1.1051606	0.0509106	0.14321

Table 5.28 Mean Quarterly Wealth from 36 Day RSI

Average across all 28 Quarters (Trigger buy at 47 and sell at 70)

For Experimental Period (Seven years from 01-01-1990)

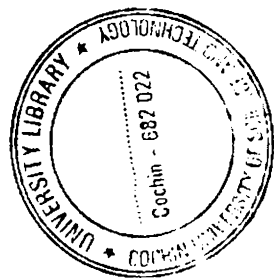| Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	111.756737	100.060409	111.817146	58.6274849	62.8430244	95.6350914	57.2405792	60.8366249	110.986731
2	108.573874	98.3396569	106.806075	68.6109937	78.2077993	90.7152293	72.6274186	48.7634772	111.966732
3	100.45502	99.3295924	99.9428538	93.6735738	96.2175788	96.3848057	92.868689	41.2507616	103.912474
4	102.14041	97.6292986	99.769709	60.1436579	66.6861081	93.1045548	186.060123	30.854415	111.63017
5	108.656978	99.428304	108.085282	65.0547941	75.2225103	89.4998886	58.1424335	59.3602767	104.044301
6	101.543828	100.392376	101.936205	55.3974852	55.6035164	100.08973	67.0618033	50.6648621	109.740963
7	100	100	100	67.9996224	67.9469382	100	53.1805264	65.708836	104.708303
8	101.690741	96.3970997	98.2852321	175.259012	183.270063	97.8774347	66.7582602	51.7562715	107.62459
9	109.151538	100.4693	109.613139	67.4856852	71.5169348	95.3464897	65.8786187	52.4414388	112.56863
10	106.391428	96.8977379	103.289166	60.3869008	70.7444174	88.3878187	114.465231	197.204591	107.395244
Average	105.036055	98.8943776	103.954481	77.263921	82.8258891	94.7041042	83.4283684	65.8841555	108.457814
Standard Deviation	4.31648401	1.48742915	4.77187207	36.0263585	36.883616	4.17232492	40.5465516	47.2017668	3.38851662

Table 5.29 Geometric Mean Return from 6 Day RSI

From wealth at the end of Seven years (Trigger buy at 51.2 and sell at 90.7)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.236049496	0.067849434	0.319914754	-0.942725612	-0.053864231	-0.946632368	-0.958171743	-0.86913534	0.138411164
2	0.075923476	-0.011619504	0.063421779	-0.919417274	-0.143542374	-0.932528056	-0.928168252	-0.915487341	0.093785947
3	-0.097182748	-0.04700301	-0.139617876	-0.965245502	-0.091584791	-0.968946165	-0.975217583	-0.785413817	0.009582518
4	0.060281142	-0.139532211	-0.08766223	-0.938814158	-0.184454333	-0.949332932	-0.911170744	-0.902362135	0.044851554
5	0.156956002	0.027969226	0.189315166	-0.734255151	-0.18338547	-0.78278966	-0.947891882	-0.883058733	0.240969474
6	0.143395778	0.015315462	0.160907413	-0.931460123	-0.081852198	-0.939573307	-0.945580383	-0.890407586	0.12734524
7	-0.008762033	-0.065471329	-0.0736597	-0.916087414	-0.150349914	-0.925069983	-0.772788137	-0.948014704	0.179382224
8	0.1225	-0.0399	0.0777	-0.8095	-0.0685	-0.8261	-0.927544211	-0.923088304	0.134892744
9	-0.006852452	-0.0009915265	-0.0077611445	-0.912344707	-0.0880099505	-0.921945114	-0.940439683	-0.896015344	0.145969553
10	0.15969523	-0.009836189	0.148288248	-0.919871662	-0.13478696	-0.926667057	-0.920762903	-0.9103968	0.010630515
Average	0.084200389	-0.020314339	0.065084611	-0.89897216	-0.118041978	-0.912558464	-0.922773552	-0.89233801	0.112582093
Standard Deviation	0.099719087	0.057041204	0.143924995	0.071034328	0.047298421	0.059428354	0.055929258	0.043566642	0.074077222

Table 5.30 Mean Quarterly Wealth from 6 Day RSI

Average across all 28 Quarters (Trigger buy at 51.2 sell at 90.7)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	106.565105	101.884322	108.884227	50.252064	51.1577973	98.9314628	46.6160103	62.1210519	106.165896
2	103.659771	99.756018	103.452666	52.5661464	55.0650111	96.4429887	53.3890182	55.5906703	104.171388
3	101.80371	99.1129039	99.2795498	44.699393	45.9146946	97.8928603	41.8432877	72.0421291	107.905015
4	102.916424	96.5699577	99.0498953	48.8467368	51.5841412	95.4551207	56.2752441	56.9634688	102.570412
5	106.393097	100.843965	107.203905	71.0220898	74.2323908	95.4856134	49.3969414	60.9980147	109.206588
6	106.418576	100.521146	107.423292	50.7744495	52.7175349	98.1630373	49.6693993	59.4699752	105.429707
7	101.917654	98.3929378	100.282282	54.8347819	56.7750825	96.2362849	71.251253	49.1481687	108.679004
8	105.203764	99.0897346	104.265887	66.5752744	68.1252706	98.3855992	54.7060393	56.0345797	106.584574
9	100.351402	100.131207	100.082207	55.046864	56.7719616	97.9274709	50.3471438	57.6379181	104.552628
10	105.069164	99.878595	105.610617	52.0385082	54.4160619	96.7882118	55.1448964	55.9650685	103.320334
Average	104.029867	99.6180787	103.553453	54.6656308	56.6759947	97.170865	52.8639233	58.5971045	105.858555
Standard Deviation	2.2236466	1.45795683	3.69333705	8.08746086	8.39898813	1.24663717	7.8006617	5.91717981	2.25989573

Table 5.31 Geometric Mean Return from 36 Day RSI

From wealth at the end of Seven years (Trigger buy at 47 and sell at 70)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.197819459	0.039032157	0.244572937	-0.8562623	-0.40960787	-0.91656845	-0.95817174	-0.86913534	0.138411164
2	0.156945119	0.068547988	0.23625138	-0.8857084	-0.2415129	-0.91414991	-0.92816825	-0.91548734	0.093785947
3	-0.019966749	0.007311635	-0.01249965	-0.91572685	-0.32054577	-0.9430774	-0.97521758	-0.78541382	0.009582518
4	0.044958597	-0.27706905	-0.24456709	-0.75297377	-0.68623165	-0.9229548	-0.91117074	-0.90236213	0.044851554
5	0.190948655	0.011377994	0.204499261	-0.61641279	-0.64070773	-0.86282228	-0.94789188	-0.883055873	0.240969474
6	0.098199252	0.022217847	0.122598875	-0.851157635	-0.54944763	-0.93308737	-0.94558038	-0.89040759	0.12734524
7	-0.05828155	-0.07593023	-0.12978644	-0.80809051	-0.69741592	-0.94202274	-0.77278814	-0.9480147	0.179382224
8	0.109154403	-0.02827921	0.077788394	-0.89198355	-0.33113845	-0.92753253	-0.92754421	-0.9230883	0.134892744
9	-0.089959768	0.0128131 08	-0.0779326	-0.77514706	-0.60023371	-0.910134444	-0.94043968	-0.89601534	0.149969553
10	0.076083682	-0.06423546	0.006960954	-0.88818308	-0.44260483	-0.93879243	-0.9207629	-0.91103968	0.010630515
Average	0.070656245	-0.02842132	0.042788601	-0.82420647	-0.49194465	-0.92111423	-0.92277355	-0.89233801	0.112582093
Standard Deviation	0.100819818	0.098004487	0.164370593	0.090394662	0.164754186	0.023588313	0.055929258	0.043566642	0.074077222

Table 5.32 Mean Quarterly Wealth from 36 Day RSI

Average across all 28 Quarters (Trigger buy at 47 and sell at 70)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	106.67737	101.46178	108.13915	56.70708	66.431591	90.448991	46.61601	62.121052	106.1659
2	106.67511	101.81692	108.31856	56.21299	61.225233	94.521083	53.389018	55.59067	104.17139
3	100.15809	100.31222	100.47031	53.193584	59.735356	92.90041	41.843288	72.042129	107.90502
4	101.93922	97.144599	98.25198	54.582558	74.842319	78.317002	56.275244	56.963469	102.57041
5	106.20465	100.41457	106.61922	63.784853	80.907982	82.338752	49.396941	60.998015	109.20659
6	103.76343	100.79871	104.56214	52.395517	66.969009	84.701692	49.669399	59.469975	105.42971
7	99.01496	98.808052	97.823012	52.108549	71.114431	79.811445	71.251253	49.148169	108.679
8	103.47755	99.548295	103.03213	53.380921	60.408214	92.201307	54.706039	56.03458	106.58457
9	98.60293	100.46114	99.064069	56.254009	72.778155	82.701162	50.347144	57.637918	104.55263
10	102.07832	98.691941	100.77026	51.085741	61.43007	88.913766	55.144896	55.965068	103.32033
Average	102.85916	99.945822	102.70508	54.97058	67.584236	86.685561	52.863923	58.597104	105.85855
Standard Deviation	3.0400616	1.4149089	4.021827	3.6461098	7.1706116	5.8267934	7.8006617	5.9171798	2.2598957

Table 5.33 Test of Significance for difference between Means of Returns

From 6 Day RSI

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.167058	-0.0384977	0.1157422	-0.4933225	-0.0667705	-0.55617	-0.3510341	-0.9317474	0.1801049
Experimental Std. Dev.	0.1141674	0.05933389	0.1390133	0.9793892	0.0468299	0.816643	1.1051606	0.0509106	0.14321
Test Period Mean	0.0842004	-0.0203143	0.0650846	-0.8989722	-0.118042	-0.9125585	-0.9227736	-0.892338	0.1125821
Test Period Std. Dev.	0.0997191	0.0570412	0.143925	0.0710343	0.0472984	0.0594284	0.0559293	0.0435666	0.0740772
Standard Error of Means	0.0479355	0.0260285	0.0632765	0.3105236	0.021048	0.2589281	0.3499297	0.0211895	0.0509868
Difference between Means	0.0828576	0.0181833	0.0506576	0.4056497	0.0512715	0.3563884	0.5717394	0.0394094	0.0675228
Difference/ S.E.	1.7285236	0.6985945	0.8005751	1.306341	**2.4359332**	1.3763993	1.6338693	1.8598578	1.3243193

Table 5.34 Test of Significance for difference between Means of Wealths

From 6 Day RSI

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	106.74149	99.31612	105.597881	76.3749167	78.7556665	98.3913992	83.4283684	65.8841555	108.457814
Experimental Std. Dev.	4.69461773	1.27793915	5.082625596	34.3603211	37.5281698	0.75248293	40.5465516	47.2017668	3.38851662
Test Period Mean	104.029867	99.6180787	103.553453	54.6656308	56.6759947	97.170865	52.8639233	58.5971045	105.858555
Test Period Std. Dev.	2.2236466	1.45795683	3.693333705	8.08746086	8.39898813	1.24663717	7.80066175	5.91717981	2.25989573
Standard Error of Means	1.64268195	0.61308781	1.98680208	11.1626103	12.1610301	0.46047093	13.0570792	15.0433368	1.28798966
Difference between Means	2.71162349	0.30195867	2.04442782	21.7092859	22.0796718	1.22053418	30.564445	7.28705099	2.59925924
Difference/ S.E.	1.65072946	0.49252109	1.02900427	1.94482162	1.81560869	**2.65062156**	2.34083324	0.4844039	2.01807462

Table 5.35 Test of Significance for difference between Means of Returns

From 36 Day RSI

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.1479268	-0.072503	0.0690286	-0.473767	-0.265639	-0.674622	-0.351034	-0.931747	0.1801049
Experimental Std. Dev.	0.105454	0.1036216	0.1809471	0.8790372	0.1731826	0.4583202	1.1051606	0.0509106	0.14321
Test Period Mean	0.0706562	-0.028421	0.0427886	-0.824206	-0.491945	-0.921114	-0.922774	-0.892338	0.1125821
Test Period Std. Dev.	0.1008198	0.0980045	0.1643706	0.0903947	0.1647542	0.0235883	0.0559293	0.0435666	0.0740772
Standard Error of Means	0.0461359	0.0451025	0.0773043	0.2794419	0.0755885	0.1451254	0.3499297	0.0211895	0.0509868
Difference between Means	0.0772705	0.0440819	0.02624	0.3504391	0.2263052	0.2464918	0.57173394	0.0394094	0.0675228
Difference/ S.E.	1.6748481	0.9773729	0.3394375	1.254068	2.9939124	1.6984747	1.6338693	1.8598578	1.3243193

Table 5.36 Test of Significance for difference between Means of Wealths

From 36 Day RSI

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	105.03606	98.894378	103.95448	77.263921	82.825889	94.704104	83.428368	65.884155	108.45781
Experimental Std. Dev.	4.316484	1.4874292	4.7718721	36.026359	36.883616	4.1723249	40.546552	47.201767	3.3885166
Test Period Mean	102.85916	99.945822	102.70508	54.97058	67.584236	86.685561	52.863923	58.597104	105.85855
Test Period Std. Dev.	3.0400616	1.4149089	4.021827	3.6461098	7.1706116	5.8267934	7.8006617	5.9171798	2.2598957
Standard Error of Means	1.6695511	0.6491851	1.9734704	11.450732	11.881998	2.2662704	13.057079	15.043337	1.2879897
Difference between Means	2.1768927	1.0514448	1.2493979	22.293341	15.241653	8.0185432	30.564445	7.287051	2.5992592
Difference/ S.E.	1.303879	1.619638	0.6330968	1.9468922	1.2827517	3.5382111	2.3408332	0.4844039	2.0180746

Part-IV

RESULTS FROM STOCHASTIC[88]

The study experimented the following two stochastic series[89].

1. 35 Day stochastic

2. 12 Day Stochastic

The trigger for action was set at 0.40 and 0.76 for buy and sell respectively, which were ascertained by optimaisation through trial and error.

The results of analysis are presented in Tables 5.37-5.48

The Tables 5.37 to 5.40 depicts the Mean returns and quarterly wealth for the experimental period; Tables 5.41 to 5.44 present the same for testing period and Tables 5.45-5.48 show the test of significance for difference between the means of the returns and the difference between the means of the wealths of the two periods-experimental period and testing period.

In Table 5.37, the Buy and Hold strategy generates an average return of 18.010% where as the best signal strategy-long cash- brings only 12.96% (Table 5.37). The Buy and hold's superiority does not change when judged by average wealth also, where the respective figures are Rs.108.455/- and Rs.104.476/- for these two best strategies (Table 5.38). It is the result from 12 Day Stochastic.

For 35 Day Stochastic, both the average wealth and average return favour Buy and Hold as the these parametres were lower for signal strategies (Tables 5.39 and 5.40).

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[88] The calculation of the stochastic indicator is explained in Chapter III

[89] These two periods are obtained by trial and error optimisation.

It is to be admitted that for both the stochastis series, signal strategy was better for three or four (by wealth and return) individual stocks. These are the result during experimental period.

During testing period, the general result is worse compared to experimental period. The buy and hold policy dominates always- when judged by average return as well as average wealth. It is true for both the 12 Day and 35 day stochastic series. The number of individual stoks for which signal strategy was better came down to one (Tables 5.41-5.44).

The test results in Tables 5.45-5.48 support inferior performance of signal strategy.

There fore, the hypothesis that ""Signal strategies using **stochastic** generates a return consistently greater than that from non-signal strategies."is rejected.

Summary of Results

The average results obtained by using signals from both the 35 Day stochastic series and 12 Day Stochastic series were inferior both in the experimental and testing periods compared to the results from buy and hold strategy. In both the periods the buy and hold strategy outperformed the signal strategies using the two stochastic series. So it may be concluded that use of signals from the analysis of stochastic series cannot yield a return better than that from a buy and hold strategy.

Table 5.37 Geometric Mean Return from 12 Day Stochastics

From wealth at the end of Seven years (Trigger buy at 0.76 and sell at 0.40)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.330440079	0.009829698	0.343518621	-0.58840841	-0.48336224	-0.74103925	-0.9032838	-0.87639494	0.193584829
2	0.176379299	-0.16897329	-0.02239738	-0.51666571	-0.69451157	-0.8123901	-0.76299566	-0.94938274	0.375688806
3	-0.01928255	-0.13809081	-0.15471062	-0.21507229	-0.83395529	-0.80676516	-0.48433693	-0.97968234	-0.00272145
4	0.047050296	-0.1161405	-0.07455465	-0.5935363	-0.62466388	-0.79588776	2.611236239	-0.99566922	0.210618686
5	0.233325486	-0.1178148	0.0880214941	1.059112182	-0.90898597	-0.73027304	-0.8974267	-0.88548444	0.068072557
6	-0.08726871	-0.36140215	-0.41713176	-0.54482708	-0.69480069	-0.78499967	-0.81380519	-0.93892702	0.26030394
7	0.203655439	-0.01993091	0.1796654496	-0.49882342	-0.67130456	-0.81042856	-0.93245417	-0.84171417	-0.01840749
8	0.104565384	-0.24828883	-0.16968586	-0.57188269	-0.66100151	-0.81970753	-0.81332481	-0.9327163	0.184522803
9	0.325443899	0.074795531	0.42458118	-0.4781733	-0.64988203	-0.81012889	-0.82387644	-0.92865868	0.404461444
10	-0.0184304	-0.18491784	-0.199940013	0.140302937	-0.83989014	-0.75033816	0.309926054	-0.98884453	0.124924746
Average	0.129587894	-0.12709339	-0.00026336	-0.28079741	-0.70623579	-0.78619581	-0.35103414	-0.93174744	0.180104887
Standard Deviation	0.147450774	0.127368402	0.260568751	0.523450294	0.123971449	0.033233017	1.105160593	0.050910606	0.143209973

Table 5.38 Mean Quarterly Wealth from 12 Day Stochastic

Average across all 28 Quarters (Trigger buy at 0.76 and sell at 0.40)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	111.29587	101.240942	113.428542	72.3926588	80.980879	85.5686667	57.2405792	60.8366249	110.986731
2	106.61053	96.2893618	101.890975	67.2819969	84.6868476	75.4095304	72.6274186	48.7634772	111.966732
3	100.441928	97.4777079	97.9150667	70.2795448	96.1411106	66.8061606	92.868689	41.2507616	103.912474
4	102.293879	97.8432069	99.4806581	68.0254747	80.7721414	79.1132501	186.060123	30.854415	111.63017
5	99.0534245	91.1285568	90.597675	69.3653099	83.1324637	75.2419777	58.1424335	59.3602767	104.044301
6	98.716106	97.6777276	96.5981034	70.9931626	76.5282523	85.2394008	67.0618033	50.6648621	109.740963
7	105.604563	99.8811714	105.400664	66.4071893	84.5891476	76.5673149	53.1805264	65.708836	104.708303
8	108.29123	98.9648312	107.210406	89.0894145	130.949139	84.3878727	66.7582602	51.7562715	107.62459
9	111.169951	102.154043	113.15199	67.8327575	85.7807272	78.9732404	65.8786187	52.4414388	112.56863
10	101.28419	96.4806417	98.6690422	89.144777	106.045285	85.8157478	114.465231	197.204591	107.395244
Average	104.476167	97.9138189	102.434312	73.0812286	90.9605993	79.3123162	83.4283684	65.8841555	108.457814
Standard Deviation	4.77853066	3.07332433	7.34196051	8.64145191	16.4425837	6.13026284	40.5465516	47.2017668	3.38851662

Table 5.39 Geometric Mean Return from 35 Day Stochastic

From wealth at the end of Seven years (Trigger buy at 0.76 and sell at 0.40)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.38889357	0.10364113	0.53284007	-0.67485055	-0.36790108	-0.764568	-0.9032838	-0.87639494	0.19358483
2	0.38247856	-0.01606341	0.36027124	-0.59969089	-0.5588528	-0.7869523	-0.76299566	-0.94938274	0.37568881
3	-0.10001863	-0.29455516	-0.36511279	-0.41902325	-0.8902706	-0.91895522	-0.48433693	-0.97968234	-0.00272145
4	-0.13009828	-0.23698236	-0.33624964	-0.7023628	-0.60136738	-0.85323231	2.61123624	-0.99566922	0.21061869
5	0.04210508	-0.21156264	-0.17836542	-0.6284084	-0.62791808	-0.81332655	-0.8974267	-0.88548444	0.06807256
6	-0.01454617	-0.16890754	-0.18099675	0.23681377	-0.83682435	-0.74271522	-0.81380519	-0.93892702	0.26030394
7	0.21411504	-0.00447211	0.20868537	-0.58473163	-0.6304213	-0.83077003	-0.93245417	-0.84171417	-0.01840749
8	0.05127675	-0.26444217	-0.22672515	0.47877461	-0.93266252	-0.88171102	-0.81332481	-0.9327163	0.1845228
9	-0.09168281	-0.14353935	-0.22206207	-0.78402526	-0.54552247	-0.87270173	-0.82387644	-0.92865868	0.40446144
10	0.11239369	-0.005561775	0.10614453	-0.49558921	-0.5901028	-0.7518901	0.30992605	-0.98884453	0.12492475
Average	0.08549168	-0.12425014	-0.03015706	-0.41730936	-0.65818434	-0.82168195	-0.35103414	-0.93174744	0.18010489
Standard Deviation	0.18940437	0.13474882	0.31110855	0.4249044	0.17559058	0.05999133	1.10516059	0.05091061	0.14320997

Table 5.40 Mean Quarterly Wealth from 35 Day Stochastics

Average across all 28 Quarters (Trigger buy at 0.76 and sell at 0.40)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	111.63861	103.05099	113.66555	70.664254	76.820283	89.732882	57.240579	60.836625	110.98673
2	112.22857	100.02074	112.11688	69.347428	81.452684	82.829573	72.627419	48.763477	111.96673
3	97.998556	95.699702	94.337281	57.057214	90.270913	62.231405	92.868689	41.250762	103.91247
4	98.719551	94.627629	93.595575	63.451842	75.669718	81.649399	186.06012	30.854415	111.63017
5	99.053425	91.128557	90.597675	69.36531	83.132464	75.241978	58.142433	59.360277	104.0443
6	99.817778	96.924024	97.04269	62.602018	70.769664	85.071101	67.061803	50.664862	109.74096
7	106.26357	100.1241	106.26118	65.517397	81.622923	79.869975	53.180526	65.708836	104.7083
8	106.15904	95.049458	101.62657	76.29961	120.40805	74.558842	66.75826	51.756271	107.62459
9	104.20389	101.20043	104.77251	72.164284	85.015095	81.262164	65.878619	52.441439	112.56863
10	100.28694	96.362492	96.752615	81.003411	108.17578	70.47381	114.46523	197.20459	107.39524
Average	103.63699	97.418812	101.07685	68.747277	87.333757	78.292113	83.428368	65.884155	108.45781
Standard Deviation	5.3146923	3.6116863	7.9398639	6.9621117	15.44922	7.9044957	40.546552	47.201767	3.3885166

Table 5.41 Geometric Mean Return from 12 Day Stochastic

From wealth at the end of Seven years (Trigger buy at 0.76 and sell at 0.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	-0.02208886	-0.19646935	-0.21421843	-0.77130687	-0.38870116	-0.73750297	-0.95817174	-0.86913534	0.138411164
2	0.003455149	-0.10187276	-0.09876959	-0.61725765	-0.5905453	-0.78272189	-0.92816825	-0.91548734	0.093785947
3	0.003455149	-0.10187276	-0.09876959	-0.61725765	-0.5905453	-0.78272189	-0.97521758	-0.78541382	0.009582518
4	-0.09256356	-0.16732798	-0.24440306	-0.67449125	-0.70763681	-0.86451321	-0.91117074	-0.90236213	0.044851554
5	0.126872001	-0.095020052	0.019796033	-0.66980075	-0.51452219	-0.76493041	-0.94789188	-0.88305873	0.240969474
6	-0.09210271	-0.24869208	-0.31788958	-0.69306195	-0.5642108	-0.78669927	-0.94558038	-0.89040759	0.12734524
7	0.020683672	-0.17860207	-0.16161254	-0.68433531	-0.60224213	-0.7893442	-0.77278814	-0.94801147	0.179382224
8	-0.13516797	-0.26255862	-0.36223707	-0.74222224	-0.56638482	-0.82737761	-0.92754421	-0.92308830	0.134892744
9	-0.13862316	-0.28448539	-0.38367228	-0.75399125	-0.52704322	-0.79266942	-0.94043968	-0.89601534	0.145969553
10	-0.09655419	-0.14666234	-0.22905567	-0.62895838	-0.70748154	-0.83378713	-0.9207629	-0.9103968	0.010630515
Average	-0.04226345	-0.17835639	-0.20908318	-0.68526833	-0.57593133	-0.7962268	-0.92277355	-0.89233801	0.112582093
Standard Deviation	0.083688892	0.069441523	0.127552342	0.055984063	0.092625864	0.036496118	0.055929258	0.043566642	0.074077222

Table 5.42   Mean Quarterly Wealth from 12 Day Stochastic

Average across all 28 Quarters (Trigger buy at 0.76 and sell at 0.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	101.093028	96.1610676	97.5008205	74.0802515	69.9369121	89.8775101	46.6160103	62.1210519	106.165896
2	100.836906	97.9036263	98.553175	69.2159605	79.2942273	80.5434784	53.3890182	55.5906703	104.171388
3	100.836906	97.9036263	98.553175	69.2159605	79.2942273	80.5434784	41.8432877	72.0421291	107.905015
4	98.3304799	96.2461874	94.9305702	62.9522225	76.8351188	74.937242	56.2752441	56.9634688	102.570412
5	104.352277	98.3525726	102.382623	70.8846654	76.3821799	84.5034417	49.3969414	60.9980147	109.206588
6	98.5362927	94.0563928	92.6425836	69.1250381	75.0485878	81.8765624	49.6693993	59.4699752	105.429707
7	101.114466	96.4384783	96.8149629	70.0135281	75.5889504	81.4920728	71.251253	49.1481687	108.679004
8	97.0543509	93.5820906	91.5059418	64.8357709	71.9037735	81.465072	54.7060393	56.0345797	106.584574
9	96.8345277	92.4811838	89.8192568	68.1860159	70.928711	83.5528163	50.3471438	57.6379181	104.552628
10	97.0543509	93.5820906	91.5059418	64.8357709	71.9037735	81.465072	55.1448964	55.9650685	103.320334
Average	99.6043584	95.6707316	95.420905	68.3345184	74.7116462	82.0256746	52.8639233	58.5971045	105.858555
Standard Deviation	2.43853803	2.10367589	4.00484463	3.29963304	3.38395056	3.73717088	7.8006617	5.91717981	2.25989573

Table 5.43 Geometric Mean Return from 35 Day Stochastics

From wealth at the end of Seven years (Trigger buy at 0.76 and sell at 0.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.0432793	-0.204209	-0.169767	-0.701175	-0.472773	-0.760862	-0.958172	-0.869135	0.1384112
2	0.0324408	0.0191889	0.0377254	-0.682258	-0.602148	-0.83683	-0.928168	-0.915487	0.0937859
3	0.0184408	0.0051889	0.0237254	-0.696258	-0.616148	-0.85083	-0.975218	-0.785414	0.0095825
4	-0.120668	-0.145449	-0.248566	-0.721959	-0.55337	-0.841961	-0.911171	-0.902362	0.0448516
5	0.1087558	-0.14731	-0.054575	-0.684193	-0.573846	-0.809601	-0.947892	-0.883059	0.2409695
6	-0.09225	-0.244441	-0.314142	-0.79253	-0.565288	-0.874564	-0.94558	-0.890408	0.1273452
7	0.0672711	-0.035396	0.0294939	-0.721812	-0.322458	-0.723889	-0.772788	-0.948015	0.1793822
8	-0.146904	-0.274044	-0.38069	-0.812732	-0.539061	-0.875176	-0.927544	-0.923088	0.1348927
9	-0.019642	-0.169378	-0.185694	-0.691706	-0.601287	-0.817774	-0.94044	-0.896015	0.1459696
10	-0.128309	-0.10593	-0.220648	-0.750299	-0.575604	-0.8519	-0.920763	-0.910397	0.0106305
Average	**-0.023759**	**-0.130178**	**-0.148314**	**-0.725492**	**-0.542198**	**-0.824339**	**-0.922774**	**-0.892338**	**0.1125821**
Standard Deviation	**0.0915756**	**0.1008319**	**0.1502769**	**0.0458361**	**0.0872065**	**0.0487793**	**0.0559293**	**0.0435666**	**0.0740772**

Table 5.44   Mean Quarterly Wealth from 35 Day Stochastics

Average across all 28 Quarters (Trigger buy at 0.76 and sell at 0.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	102.082496	97.4860986	98.5051082	72.084517	75.7430615	86.6143305	46.6160103	62.1210519	106.165896
2	100.253822	99.6223732	100.715272	63.3728882	75.3499212	80.8582181	53.3890182	55.5906703	104.171388
3	101.177369	100.54592	101.638819	64.2964352	76.2734682	81.7817651	41.8432877	72.0421291	107.905015
4	97.3599202	96.7541721	94.2826815	64.7148425	74.7914088	83.81004	56.2752441	56.9634688	102.570412
5	103.613649	99.10915	101.572639	68.0657025	76.2528357	83.3115965	49.3969414	60.9980147	109.206588
6	98.4101301	95.0185922	93.6862985	61.7975962	69.4132582	84.0247735	49.6693993	59.4699752	105.429707
7	104.758682	99.823168	103.860114	75.2030349	74.6746433	91.7641409	71.251253	49.1481687	108.679004
8	96.274888	93.0756061	89.7321789	60.6663776	67.4263193	83.6921195	54.7060393	56.0345797	106.584574
9	99.7191817	96.0617516	95.6389906	66.4479489	75.7741114	81.6126764	50.3471438	57.6379181	104.552628
10	97.3930085	97.67436	94.7221205	63.827827	73.6922486	82.9298981	55.1448964	55.9650685	103.320334
Average	100.104315	97.5171192	97.4354222	66.047717	73.9391276	84.0399559	52.8639233	58.5971045	105.858555
Standard Deviation	2.82118063	2.36064254	4.49553165	4.57582725	3.04854344	3.15069346	7.8006617	5.91717981	2.25989573

Table 5.45 Test of Significance for difference between Means of Returns

From 12 Day Stochastic

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.129588	-0.12709	-0.00026	-0.2808	-0.70624	-0.7862	-0.35103	-0.93175	0.180105
Experimental Std. Dev.	0.147451	0.127368	0.260569	0.52345	0.123971	0.033233	1.105161	0.050911	0.14321
Test Period Mean	-0.04226	-0.17836	-0.20908	-0.68527	-0.57593	-0.79623	-0.92277	-0.89234	0.112582
Test Period Std. Dev.	0.083689	0.069442	0.127552	0.055984	0.092626	0.036496	0.055929	0.043567	0.074077
Standard Error of Means	0.053615	0.045875	0.091742	0.166474	0.048937	0.015609	0.34993	0.021189	0.050987
Difference between Means	0.171851	0.051263	0.20882	0.404471	0.130304	0.010031	0.571739	0.039409	0.067523
Difference/ S.E.	3.205291	1.117458	2.276167	2.429641	2.662689	0.642642	1.633869	1.859858	1.324319

Table 5.46 Test of Significance for difference between Means of Wealths

From 12 Day Stochastic

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	104.47617	97.913819	102.43431	73.081229	90.960599	79.312316	83.428368	65.884155	108.45781
Experimental Std. Dev.	4.7785307	3.0733243	7.3419605	8.6414519	16.442584	6.1302628	40.546552	47.201767	3.3885166
Test Period Mean	99.604358	95.670732	95.420905	68.334518	74.711646	82.025675	52.863923	58.597104	105.85855
Test Period Std. Dev.	2.438538	2.1036759	4.0048446	3.299633	3.3839506	3.7371709	7.8006617	5.9171798	2.2598957
Standard Error of Means	1.6964912	1.1777425	2.644677	2.9251029	5.308575	2.2703869	13.057079	15.043337	1.2879897
Difference between Means	4.8718087	2.2430873	7.0134073	4.7467102	16.248953	2.7133584	30.564445	7.287051	2.5992592
Difference/ S.E.	2.871697	1.9045651	2.6518956	1.6227498	3.060888	1.1951083	2.3408332	0.4844039	2.0180746

Table 5.47 Test of Significance for difference between Means of Returns

From 35 Day Stochastic

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.08549168	-0.1242501	-0.0301571	-0.4173094	-0.6581843	-0.8216819	-0.3510341	-0.9317474	0.18010489
Experimental Std. Dev.	0.18940437	0.13474882	0.31110855	0.4249044	0.17559058	0.05999133	1.10516059	0.05091061	0.14320997
Test Period Mean	-0.0237586	-0.130178	-0.1483137	-0.7254924	-0.5421983	-0.8243386	-0.9227736	-0.892338	0.11258209
Test Period Std. Dev.	0.09157565	0.10083195	0.15027695	0.04583611	0.08720652	0.04877928	0.05592926	0.04356664	0.07407722
Standard Error of Means	0.06652828	0.0532206	0.10925735	0.13514611	0.0619976	0.02445072	0.34992971	0.02118948	0.05098679
Difference between Means	0.109250033	0.00592783	0.11815663	0.30818299	0.115986	0.00265668	0.57173941	0.03940943	0.06752279
Difference/ S.E.	1.64216384	0.11138229	1.08145246	2.28036904	1.87081426	0.10865439	1.6338693	1.85985784	1.32431927

Table 5.48 Test of Significance for difference between Means of Wealths

From 35 Day Stochastic

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	103.636992	97.4188124	101.076853	68.7472767	87.3337572	78.2921129	83.4283684	65.8841555	108.457814
Experimental Std. Dev.	5.31469226	3.6116863	7.93986386	6.9621117	15.4492199	7.90449573	40.5465516	47.2017668	3.38851662
Test Period Mean	100.104315	97.5171192	97.4354222	66.047717	73.9391276	84.0399559	52.8639233	58.5971045	105.858555
Test Period Std. Dev.	2.82118063	2.36064254	4.49553165	4.57582725	3.04854344	3.15069346	7.8006617	5.91717981	2.25989573
Standard Error of Means	1.90276152	1.36443802	2.88532915	2.63456248	4.97967884	2.69087202	13.0570792	15.0433368	1.28798966
Difference between Means	3.53267762	0.0983068	3.64143056	2.69955969	13.3946296	5.74784303	30.564445	7.28705099	2.59925924
Difference/ S.E.	1.85660556	0.0720493	1.26205032	1.02467097	2.68985812	2.13605218	2.34083324	0.4844039	2.01807462

Part-V

RESULTS FROM RATE OF CHANGE INDEX[90]

The two ROC series computed and evaluated in this study are mentioned below[91]: These two different periods were selected as they were found to be the best periods when the preliminary study of two stocks from 2 days to 60 days were experimented, as done in the selection of periods for MA, MACD and RSI. The best two periods in respective category of short term and long term are the following and which were taken for detailed analysis of all the stocks selected.

1. 12 Day ROC

2. 28 Day ROC

For both the series the buy and sell triggers were set at 0.76 and 1.4. These triggers were found to give optimum results for all stocks.

The results are presented in Tables 5.48-5.60. The Tables 5.49 to 5.52 depicts the Mean returns and quarterly wealth for the experimental period; Tables 5.53 to 5.56 present the same for testing period and Tables 5.57-5.60 show the test of significance for difference between the means of the returns and the difference between the means of the wealths of the two periods-experimental period and testing period.

In Table 5.49 and 5.50, five out of ten stocks are found out performing (either by long-cash or by long short combination) when judged either by quarterly wealth or by return, when signals from 12 Day ROC is used. For 28 Day ROC, same is the result when judged by return (Table 5.51). But the number of stocks to which signal strategy is better comes down to two when judged by wealth (Table 5.52). However, in

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[90] The calculation of the Rate of Change Index is explained in Chapter III
[91] These two periods are obtained by trial and error optimisation.

all cases average result favours buy and hold policy. These are the result during the experimental period.

During testing period also, Buy and Hold dominates always when judged by average return as well as average wealth, though with a performance worse than that of experimental period. It is true for both the 12 Day ROC and 28 Day ROC (Tables 5.53-5.56). In respect of the performance signal strategy, the position of individual stocks does not differ much from that experimental period.

The results of the test of significance in tables 5.57 to 5.60 also recognise the continuing inferior performance of signal strategies and supports that persistence of superiority of buy and hold policy in both the experimental and testing period. Therefore, the hypothesis that "signal strategies using *Rate of Change Index* generates a return consistently greater than that from non-signal strategies" is not acceptable and stands rejected.

Sumary of the result

Though, it is true that ROC results in better performance for some of the individual stocks, its average performance for all stocks does not favour its use as signalling tool. During the experimental period, the performance of the two ROC series were reaching the buy and hold results but could not exceed it. But during the testing period, the performance of the two Indicators were very poor. So it can be concluded that the analysis of ROC indicator also does not yield a return better than that from a buy and hold strategy.

Table 5.49 Geometric Mean Return from 12 Day ROC

From wealth at the end of Seven years (trigger for buy at 0.75 and sell at 1.40)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.15107614	-0.012121	0.091231	-0.91651067	-0.35047907	-0.87082152	-0.9032838	-0.87639494	0.19358483
2	0.07291356	0.04302616	0.1190769	-0.71051174	-0.36504718	-0.55138379	-0.76299566	-0.94938274	0.37568881
3	0.18439299	0.02356152	0.21229909	-0.89731628	-0.89351512	-0.03119556	-0.48433693	-0.97968234	-0.00272145
4	0.10078256	-0.07182484	0.02171902	-0.81710199	-0.72008618	-0.35221461	2.61123624	-0.99566922	0.21061869
5	0.15306175	0.01934868	0.17537198	-0.92549068	-0.90849741	-0.17291019	-0.8974267	-0.88548444	0.06807256
6	0.25864895	0.01956008	0.28326822	-0.80779585	-0.80495335	-0.01032372	-0.813880519	-0.93892702	0.26030394
7	0.0820209	-0.27345416	-0.21386221	-0.95485182	0.90918625	-0.97635802	-0.93245417	-0.84171417	-0.01840749
8	0.1788935	0.00542	0.1788935	-0.8902264	-0.32140708	-0.83814009	-0.81332481	-0.9327163	0.1845228
9	0.24725736	0.0482361	0.30742019	-0.75350048	-0.00398071	-0.74910807	-0.82387644	-0.92865868	0.40446144
10	0.21317238	0.08011925	0.31037085	-0.87986352	-0.25590403	-0.83592588	0.30992605	-0.98884453	0.12492475
Average	0.164222	-0.01181282	0.14857885	-0.85531694	-0.37146839	-0.53883814	-0.35103414	-0.93174744	0.18010489
Standard Deviation	0.06518841	0.10034719	0.15876665	0.07973229	0.54383853	0.36962598	1.10516059	0.05091061	0.14320997

Table 5.50 Mean Quarterly Wealth from 12 Day ROC

Average across all 28 Quarters (trigger for buy at 0.75 and sell at 1.40)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	105.991047	93.7684501	99.7594967	56.7257344	91.3348271	65.4223829	57.2405792	60.8366249	110.986731
2	102.958158	101.163775	104.121933	83.6429182	96.7664839	86.8789585	72.6274186	48.7634772	111.966732
3	108.105073	100.632348	110.172485	58.0130896	58.733012	99.2894196	92.868689	41.2507616	103.912474
4	102.868414	99.0582322	101.926647	66.5796522	74.4931357	91.5436772	186.060123	30.854415	111.63017
5	104.928514	100.763797	107.196556	54.6386155	58.9340125	96.0358441	58.1424335	59.3602767	104.044301
6	114.300618	100.518651	116.896035	67.2957599	67.5994152	99.7497644	67.0618033	50.6648621	109.740963
7	102.493157	96.8128578	99.3005605	156.574511	123.649336	176.80436	53.1805264	65.708836	104.708303
8	107.730798	100	107.730798	59.1373444	91.9779268	66.9914322	66.7582602	51.7562715	107.62459
9	109.420838	101.64573	112.712056	86.8023151	104.372408	83.6267796	65.8786187	52.4414388	112.56863
10	110.241939	102.554105	112.796044	60.960763	93.7971421	67.6932111	114.465231	197.204591	107.395244
Average	106.903856	99.6917946	107.2613	75.0370703	86.1657699	93.4035829	83.4283684	65.8841555	108.457814
Standard Deviation	3.80583805	2.59840999	5.96132404	30.7036973	20.9303007	32.1812986	40.5465516	47.2017668	3.38851662

Table 5.51 Geometric Mean Return from 28 Day ROC

From wealth at the end of Seven years (trigger for buy at 0.75 and sell at 1.40)

For Experimental Period (Seven years from 01-01-1990)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0.308028682	-0.03620815	0.260667381	-0.44550047	-0.70151462	-0.83731039	-0.9032838	-0.87639494	0.193584829
2	0.229471453	0.145113249	0.40788405	-0.27221281	-0.59128404	-0.70062811	-0.76299566	-0.94938274	0.375688806
3	-0.06941489	-0.142542	0.3222	-0.68006461	-0.61364727	-0.87459228	-0.48433693	-0.97968234	-0.00272145
4	0.122666883	-0.04930788	0.06731056	-0.34690891	-0.83636762	-0.89218689	2.611236239	-0.99566922	0.210618686
5	0.223985127	0.071516815	0.311520645	-0.88821057	-0.21058832	-0.91045639	-0.8974267	-0.88548444	0.068072557
6	0.205190163	-0.02806714	0.171363925	-0.7783292	-0.09887163	-0.80231028	-0.81380519	-0.93892702	0.26030394
7	0.104148929	-0.0902021	0.345247	0.186933262	-0.94712077	-0.93743535	-0.93245417	-0.84171417	-0.01840749
8	0.185727128	-0.1235401	-0.0942131	-0.37219591	-0.76836163	-0.85410379	-0.81332481	-0.9327163	0.184522803
9	0.187998194	-0.08930795	0.081900514	-0.06481694	-0.79234516	-0.7993998	-0.82387644	-0.92865868	0.404461444
10	0.2008807	0.055637789	0.267695047	-0.34892195	-0.8394526	-0.89603067	0.309926054	-0.98884453	0.124924746
Average	0.1698682	-0.02869075	0.214157602	-0.40102281	-0.63995536	-0.8504454	-0.35103414	-0.93174744	0.180104887
Standard Deviation	0.101194264	0.092651828	0.155223326	0.323410156	0.278171918	0.069222495	1.105160593	0.050910606	0.143209973

Table 5.52 Mean Quarterly Wealth from 28 Day ROC

Average across all 28 Quarters (trigger for buy at 0.75 and sell at 1.40)

For Experimental Period (Seven years from 01-01-1990)

| Stock Serial Number | Using Signal | | | | | | Without Signal | | |
| | Terminal | | | Daily | | | Daily | | Terminal |
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	111.174406	99.4392082	111.60992	66.3360322	88.9008104	78.1553407	57.2405792	60.8366249	110.986731
2	106.94224	103.940056	110.882296	83.0260224	98.217684	84.923389	72.6274186	48.7634772	111.966732
3	98.4156496	100.632348	110.172485	58.0130896	58.733012	99.2894196	92.868689	41.2507616	103.912474
4	103.516041	99.3388924	101.997037	59.6600054	91.548027	67.6511588	186.060123	30.854415	111.63017
5	106.199372	101.933777	108.133149	57.0803565	61.030506	95.0719572	58.1424335	59.3602767	104.044301
6	107.26475	99.4576547	107.36298	67.6710773	70.1228631	97.7357723	67.0618033	50.6648621	109.740963
7	102.988454	90.4754604	93.6993149	74.0239414	119.738972	68.7820729	53.1805264	65.708836	104.708303
8	105.927062	95.8718822	97.5137989	63.609244	90.1460873	73.270681	66.7582602	51.7562715	107.62459
9	105.719506	98.9936817	104.747272	80.0704885	101.542686	79.722644	65.8786187	52.4414388	112.56863
10	109.291535	102.554105	112.796044	60.960763	93.7971421	67.6932111	114.465231	197.204591	107.395244
Average	105.743902	99.2637065	105.89143	67.045102	87.3777791	81.2295647	83.4283684	65.8841555	108.457814
Standard Deviation	3.53279554	3.80908485	6.37799638	9.18263268	18.992428	12.4787862	40.5465516	47.2017668	3.38851662

Table 5.53   Geometric Mean Return from 12 Day ROC

From wealth at the end of Seven years (trigger for buy at 0.75 and sell at 1.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	0	0	0	-0.92691695	0	-0.92688896	-0.95817174	-0.86913534	0.138411164
2	0	0	0	-0.92691695	0	-0.92688896	-0.92816825	-0.91548734	0.093785947
3	0.057908019	0.084437399	0.147723502	-0.7618869	-0.55177692	-0.89387788	-0.97521758	-0.78541382	0.009582518
4	0.282397666	0.0459192	0.34128434	-0.38422577	-0.73847096	-0.84069682	-0.91117074	-0.90236213	0.044851554
5	0	0	0	-0.94472039	0	-0.94490602	-0.94789188	-0.88305873	0.240969474
6	0.201655815	0.011899234	0.215954598	-0.60543546	-0.56824933	-0.82871829	-0.94558038	-0.89040759	0.12734524
7	0.133054563	0.021045368	0.156900113	-0.93411274	0.029020712	-0.93298454	-0.77278814	-0.9480147	0.179382224
8	-0.12077238	-0.24124442	-0.33288114	-0.89583491	-0.22290927	-0.91924607	-0.92754421	-0.9230883	0.134892744
9	0	0	0	-0.93997468	0	-0.94001007	-0.94043968	-0.89601534	0.145969553
10	-0.06741323	-0.03253901	-0.09775868	-0.85013991	-0.31313021	-0.89394311	-0.9207629	-0.9103968	0.010630515
Average	0.048683046	-0.01104822	0.043073425	-0.81701647	-0.2365516	-0.90481607	-0.92277355	-0.89233801	0.112582093
Standard Deviation	0.123333552	0.086833028	0.185957163	0.186105668	0.290921738	0.040773016	0.055929258	0.043566642	0.074077222

Table 5.54   Mean Quarterly Wealth from 12 Day ROC

Average across all 28 Quarters (trigger for buy at 0.75 and sell at 1.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	100	100	100	53.6159812	53.637048	100	46.6160103	62.1210519	106.165896
2	100	100	100	53.6159812	53.637048	100	53.3890182	55.5906703	104.171388
3	101.561768	102.345303	104.09239	58.5072884	73.6229592	84.6611728	41.8432877	72.0421291	107.905015
4	114.044309	101.318797	115.363106	64.913518	90.3798361	74.5589338	56.2752441	56.9634688	102.570412
5	100	100	100	49.772984	49.8922259	100	49.3969414	60.9980147	109.206588
6	104.991015	100.560542	106.334907	51.898847	51.6948431	100.791828	49.6693993	59.4699752	105.429707
7	97.8791833	96.9456485	94.8248318	55.8859121	59.8643776	95.7936744	71.251253	49.1481687	108.679004
8	98.8603007	99.3468079	98.4319213	59.3709356	65.5662255	92.682785	54.7060393	56.0345797	106.584574
9	100	100	100	50.5958647	50.483839	100	50.3471438	57.6379181	104.552628
10	105.927032	100.723027	106.650059	67.212251	82.190738	84.8754787	55.1448964	55.9650685	103.320334
Average	**102.326361**	**100.124013**	**102.569721**	**56.5389563**	**63.096914**	**93.3363873**	**52.8639233**	**58.5971045**	**105.858555**
Standard Deviation	**4.84652121**	**1.40153018**	**5.77671158**	**5.92630958**	**14.4480493**	**9.06215006**	**7.8006617**	**5.91717981**	**2.25989573**

Table 5.55   Geometric Mean Return from 28 Day ROC

From wealth at the end of Seven years (trigger for buy at 0.75 and sell at 1.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	-0.04340523	0.02571026	-0.01881093	-0.84465126	-0.61861771	-0.9407401	-0.95817174	-0.86913534	0.13841116
2	-0.04340523	0.02571026	-0.01881093	-0.84465126	-0.61861771	-0.9407401	-0.92816825	-0.91548734	0.09378595
3	0.04748582	0.06244751	0.1128987	-0.88928257	-0.07396635	-0.89692517	-0.97521758	-0.78541382	0.00958252
4	0.12682943	0.02048435	0.1499118	-0.85907978	-0.51080522	-0.93126549	-0.91117074	-0.90236213	0.04485155
5	-0.05244726	-0.15531314	-0.19961465	-0.73772692	-0.73257946	-0.92925555	-0.94789188	-0.883055873	0.24096947
6	0.17826052	-0.05709086	0.11099262	-0.40296314	-0.79037044	-0.87212602	-0.94558038	-0.89040759	0.12734524
7	0	0	0	-0.93612153	0	-0.93705347	-0.77278814	-0.9480147	0.17938222
8	0.05570858	-0.21050543	-0.1665238	-0.87655778	-0.26475742	-0.90908018	-0.92754421	-0.9230883	0.13489274
9	0	0	0	-0.93901604	0	-0.93905199	-0.94043968	-0.89601534	0.14596955
10	0.06083244	0.04783756	0.11158007	-0.71980327	-0.64541401	-0.89916144	-0.9207629	-0.9103968	0.01063052
Average	0.03298591	-0.02407195	0.00816229	-0.80498535	-0.42551283	-0.91953995	-0.92277355	-0.89233801	0.11258209
Standard Deviation	0.07641953	0.09057179	0.11907364	0.1587675	0.31076445	0.0238104	0.05592926	0.04356664	0.07407722

Table 5.56 Mean Quarterly Wealth from 28 Day ROC

Average across all 28 Quarters (trigger for buy at 0.75 and sell at 1.40)

For Testing Period (Seven years from 01-01-1997)

Stock Serial Number	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
1	99.81502258	100.6945125	100.5095351	51.14489652	67.80819389	83.29738384	46.61601035	62.1210519	106.1658961
2	99.81502258	100.6945125	100.5095351	51.14489652	67.80819389	83.29738384	53.38901816	55.59067026	104.1713877
3	101.3469984	101.6941387	103.2996276	58.11532396	59.28076852	98.42608272	41.84328772	72.04212915	107.905015
4	105.6984277	100.5983728	106.2968005	53.21874705	65.84740962	86.64132757	56.27524411	56.96346878	102.5704119
5	100.2818304	97.52432312	97.80615348	53.54746658	77.63668378	75.7855304	49.39694137	60.99801472	109.20655879
6	100	100	100	51.42418628	51.57600946	100	49.66939926	59.4699752	105.429707
7	104.8603411	97.61772841	102.1650731	57.32562715	62.44200589	94.47005099	71.25125295	49.14816869	108.6790035
8	102.8906137	102.4835985	105.3812186	58.71935195	76.70007186	81.10149168	54.70603928	56.03457973	106.5845744
9	100	100	100	50.89848307	50.78645736	100	50.34714381	57.63791807	104.552628
10	105.935678	99.73002473	105.6657027	63.24055849	89.63090489	72.46793009	55.14489639	55.96506845	103.32033335
Average	102.0643934	100.1037211	102.1633646	54.87795376	66.95166992	87.54871811	52.86392334	58.59710449	105.8585545
Standard Deviation	2.560988918	1.568106167	2.883154732	4.233733069	12.03301037	10.11396876	7.800661702	5.91717981	2.259895729

Table 5.57 Test of Significance for difference between Means of Returns

From 12 Day ROC

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.164222	-0.011813	0.1485789	-0.855317	-0.371468	-0.538838	-0.351034	-0.931747	0.1801049
Experimental Std. Dev.	0.0651884	0.1003472	0.1587667	0.0797323	0.5438385	0.369626	1.1051606	0.0509106	0.14321
Test Period Mean	0.048683	-0.011048	0.0430734	-0.817016	-0.236552	-0.904816	-0.922774	-0.892338	0.1125821
Test Period Std. Dev.	0.1233336	0.086833	0.1859572	0.1861057	0.2909217	0.040773	0.0559293	0.0435666	0.0740772
Standard Error of Means	0.04441143	0.0419637	0.077322	0.0640254	0.1950374	0.117595	0.3499297	0.0211895	0.0509868
Difference between Means	0.115539	0.0007646	0.1055054	0.0383005	0.1349168	0.3659779	0.5717394	0.0394094	0.0675228
Difference/ S.E.	2.6190832	0.0182204	1.3644943	0.5982072	0.6917484	3.1121899	1.6338693	1.8598578	1.3243193

Table 5.58 Test of Significance for difference between Means of Wealths

Statistic	Using Signal						Without Signal		
	Terminal		Daily				Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	106.90386	99.691795	107.26126	75.03707	86.16577	93.403583	83.428368	65.884155	108.45781
Experimental Std. Dev.	3.805838	2.59841	5.961324	30.703697	20.930301	32.181299	40.546552	47.201767	3.3885166
Test Period Mean	102.32636	100.12401	102.56972	56.538956	63.096914	93.336387	52.863923	58.597104	105.85855
Test Period Std. Dev.	4.8465212	1.4015302	5.7767116	5.9263096	14.448049	9.0621501	7.8006617	5.9171798	2.2598957
Standard Error of Means	1.9486706	0.9335963	2.6250292	9.88857	8.0425345	10.57241	13.057079	15.043337	1.2879897
Difference between Means	4.5774947	0.432218	4.6915396	18.498114	23.068856	0.0671956	30.564445	7.287051	2.5992592
Difference/ S.E.	2.3490346	0.4629603	1.7872333	1.8706561	2.8683564	0.0063558	2.3408332	0.4844039	2.0180746

Table 5.59 Test of Significance for difference between Means of Returns

From 28 Day ROC

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	0.1698682	-0.028691	0.2141576	-0.401023	-0.639955	-0.850445	-0.351034	-0.931747	0.1801049
Experimental Std. Dev.	0.1011943	0.0926518	0.1552333	0.3234102	0.2781719	0.0692225	1.1051606	0.0509106	0.14321
Test Period Mean	0.0329859	-0.024072	0.0081623	-0.804985	-0.425513	-0.91954	-0.922774	-0.892338	0.1125821
Test Period Std. Dev.	0.0764195	0.09057118	0.1190736	0.1587675	0.3107644	0.0238104	0.0559293	0.0435666	0.0740772
Standard Error of Means	0.0401002	0.04099727	0.0618675	0.1139304	0.1318917	0.0231488	0.3499297	0.0211895	0.0509868
Difference between Means	0.1368823	0.0046188	0.2059953	0.4039625	0.2144425	0.0690946	0.5717394	0.0394094	0.0675228
Difference/ S.E.	3.4135113	0.1127287	3.3296198	3.5456974	1.6258988	2.9847953	1.6338693	1.8598578	1.3243193

Table 5.60 Test of Significance for difference between Means of Wealths

From 28 Day ROC

Statistic	Using Signal						Without Signal		
	Terminal			Daily			Daily		Terminal
	Long-Cash	Short-Cash	Long-Short	Long-Cash	Short-Cash	Long-Short	Long only	Short only	Buy and Hold
Experimental Mean.	105.743902	99.2637065	105.89143	67.045102	87.3777791	81.2295647	83.4283684	65.8841555	108.457814
Experimental Std. Dev.	3.53279554	3.80908485	6.37799638	9.18263268	18.992428	12.4787862	40.5465516	47.2017668	3.38851662
Test Period Mean	102.064393	100.103721	102.163365	54.8779538	66.9516699	87.5487181	52.8639233	58.5971045	105.858555
Test Period Std. Dev.	2.56098892	1.56810617	2.88315473	4.23373307	12.0330104	10.1139688	7.8006617	5.91717981	2.25989573
Standard Error of Means	1.37983001	1.302616	2.21340053	3.19758094	7.10989214	5.07949277	13.0570792	15.0433368	1.28798966
Difference between Means	3.67950822	0.84001457	3.72806526	12.1671483	20.4261091	6.31915346	30.564445	7.28705099	2.59925924
Difference/ S.E.	2.66663879	0.64486739	1.6843157	3.80511033	2.87291407	1.24405206	2.34083324	0.4844039	2.01807462

CONCLUSION ON TECHNICAL INDIACATORS

In Tables containing GM return, the amount of variability, measured by standard deviation, has been greater than their respective mean returns. It means lower average mean return is amidst the extremities of too small (negative) return and too high positive returns. Therefore, an Indicator should not always be upheld as good for its extreme positive returns and downgraded for extreme negative returns. Success of Indicator is found to be stock specific as some indicator performs better for some stocks. Comparing the performance of the Terminal Long-Cash strategy, the stock with serial number 3 performed better when 6 day ROC is used (return of 18.4339% -Table 5.49) where as the return is negative when 15 DMA is uded (-21.0768%- Table 5.1). As the hypothsis in respect of each of the five technical indicators is rejected, it is concluded that generally technical indicators can not generate a return consistently greater than that from a buy and hold policy. So the study does not find any evidence supporting the holding that technical indicators can consistently out-perform a buy and hold strategy in the Indian stock market. However the study admits that casual wins are possible from them in some individual cases.

CHAPTER VI

FINDINGS AND

CONCLUSIONS

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The study was to examine 'the current validity of traditional patterns' and 'the consistent superiority, if any, of technical indicators' in the Indian stock market The analysis and results of the study are in Chapter Four and Chapter Five respectively. The results lead to the following findings.

FINDINGS

The findings of the study may be summarised in the following points.

1. Traditional patterns occur in the stock charts of companies in Indian Stock market with varying frequencies ranging from 63 Head and Shoulders Bottoms to 238 Falling Wedges for ten companies during a period of fourteen years ending on first January 2004. The number of patterns is fewer and it limits the trading opportunities of the system trader using signals from the patterns. So the possibility of trade to the signal user is limited.

2. The patterns give valid signals in the way expected or traditionally held, except in a small percentage of the total number of patterns analysed (Table 5.1). Sell signals are given by Head and Shoulders Tops and Rising Wedges where as Falling Wedges and Head and Shoulders Bottoms gave buy signals while Symmetrical Triangles gave either of the signals.

3. The post-pattern- behaviour of prices is also in the expected direction though it is not true always for all the patterns. There were 16.26% of the STs, 14.68% of the RWs, 16.39% of the FWs, 21.25% of the HSTs and 11.43% of the HSBs with post-pattern price behaviour in the direction opposite to the direction signaled. This

239

caused the negative achievement of price objective in each category of patterns examined.

4. The most important thing is that the extent of the post-pattern price behaviour in majority of cases was not at least equal to or greater than the price objective as expected in the traditional holding. The best statistical expectation possible is (47.119% of the Symmetrical Triangles, 43.10% of the Rising Wedges, 47.00% of the Falling Wedges, 18.17% of the Head and Shoulders Tops and 46.69% of the Head and Shoulders Bottoms. This is the condition even while waiting till the third reversal day. So patterns do not maintain their traditional holding with respect to the achievement of their price objective.

5. It does not mean that there are no usable signals from patterns. Truly there are! The extent of movement of prices after breakout has been very extensive in some cases. The percentage of achievement of price objective has gone to an extent of even above 300%. That means if patterns propose a change of 10%, the actual change comes to 30% in the expected way. Then why the net average achievement is poor? It is poor because there were patterns which signaled action but price behaviours have been not only against the expected direction but they were substantial also. This is evident from the extreme negative achievement of price objective by patterns. The negative extreme performance of patterns point towards the extent of risk from acting on signals given by patterns.

6. Of the five patterns analysed, Head and Shoulders Bottom is the only patten in the case of which there were no trend-wise difference in respect of the frequency of occurrence, probability of success, and the achievement of price objective.

7. Even when majority of the patterns fail, predictability may be established by average achievement. However, the success by this way is not practically realizable always[92]. Such predictability based on average achievement is not a realisable one.

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[92] High Standard Deviation (σ) sometimes exceeding the respective mean achievements.

8. Trend has its impact in the predictability of prices by patterns. Down trends favour patterns to achieve their price objective when they give sell signals while up trends do the same for patterns with buy signals. However there were instances of post-pattern price movements indifferent to either trend. Most of the patterns are found succeeding in pro-trend actions rather than in anti-trend actions. It may be attributed to the influence of the trend. So pro-trend signals are better than anti-trend signals to act upon.

9. Demad and supply balances inside patterns, as reflected by Candles, are not found independently explaining the extent or direction of the post pattern behaviour of price. So price movements inside patterns has little relevance in the success or failure of a pattern.

10. The number of 'patterns with negative achievement of price objective' is also on the increase on successive reversal days. So longer holding period after acting on signals is attached with increased risks. However there are exceptions to it.

11. As to the use of indicators, the period selected for its calculation, the trigger and filters set influence the result. The indicator that was successful once need not be so at other periods, It is revealed by the difference in the results of experimental period and testing period.

12. The returns differ with stock, time and the indicator used. When the ten stocks analysed are individually taken, in some cases, signal strategies out perform non-signal strategies, during experimental or testing period for certain indicators but not for the other period or for the other indicator.

13. Different Technical Indicators have varying predictive capacity. Certain indicators generate a return greater than that of buy and hold strategy while 'Buy and Hold' strategy outperform others but consistent superiority is not found for any of the five indicators evaluated.

Conclusion

Though there are wide spread talk and propaganda on technical analysis (among stock market participants and others), the present study finds that the analysis of patterns in the traditional way to foretell prices is a futile attempt. However, technical indicators are found winning in certain cases but consistency in such superiority is absent. That is the predictability of technical analysis is absent with respect to patterns and is relative with respect to some of the indicators in the Indian stock market.

Implications for the trader using signals from patterns and indicators

1. Invalid patterns (signals where from are not valid traditionally), though in small percentage, give a caution to the users of patterns as a signaling tool not to act prematurely.

2. The probability of failed patterns (where post-pattern price movements was in the direction opposite to the direction signalled or patterns which could not attain their traditional price objective) is more than fifty and it indicates chance for a failure is more for a system trader depending on signals from patterns.

3. As an investor waits more and more, the number of patterns with negative acievement of price objective is also on the increase. So longer holding period after acting on signal is attached with increased risks.

4. Practically, portfolio revision instantly with signal generation is not easy and profitable, as switch over is costly. So many valid signals will have to be ignored.

5. Technical indicator may work occasionally for individual stocks. But consistent success from their use need not be expected.

6. Transaction cost is influential as it gets lowers, any indicator or predictive tool, for that matter, can be more successful. Changes in transaction cost in a stock market over a period can be one of the reasons for the success or failure of technical indicator in a particular time period or market.

BIBLIOGRAPHY

Aggarwal. K.P., 'Equity Price Behaviour in India since 1951 – 52', *Indian Journal of Economics* Vo. 46, July 1965.

Alexander, Sidney S., "Price Movements in Speculative Markets: Trends or Random Walks .", *Industrial Management Review*, 1961.

Alexander, Sidney S., "Price Movements in Speculative Markets: Trends or Random Walks No.2", *Industrial Management Review*, 1964.

Allen H, Taylor M.P. "the use of technical analysis in the foreign exchange market", *Journal of International Money and Finance,* 1999.

Allen, F. and Karjalainen R., "Using Genetic Algorithms to Find Technical Trading Rules.", *Journal of Financial Economics*, 51, 1999.

Barua and Raghunathan., 'Inefficiency and Speculation in Indian Capital Markets', *Vikalpa*, 12, 1986.

Bauer Jr. Richard J. and Dahlquist Julie R., Technical Market Indicators: Analysis & Performance, John Wiley & Sons, Inc. New York the USA., 1999.

Bernstein, Leopold A., 'In Defence of Fundamental Analysis' *Financial Analyst Journal,* 1975.

Blume, Lawrence Easley, David and O'Hara, Maureen, **"Market Statistics and Technical Analysis: The Role of Volume",** *Journal of Finance*, Mar., 1994.

Boldt, Bob L., and Hal L. Arbit 'Efficient Market and Professional Investor' *Fianncial Analyst Journal*, 1984.

Brush, J.S., "Eight Relative Strength Models Compared.", *Journal of Portfolio Management,* 1986.

Chang PHK, Osler CL "Methodical Madness: Technical Aanalysis and the Irrationality of Exchange-rate Forecasts", *Economics Journal,* 1999.

Chang, Pao.L., and M. King Deets, 'Portfolio Returns and Random Walk Theory' *Journal of Finance*, January 1971.

Chaudhuri, S.K., "Short-run Share Price Behaviour: New Evidence on Weak Form of Market efficiency.", *Vikalpa*, 16, 1991.

Colby, Robert W. and Mayers Thomas A., The Encyclopedia of Technical Market Indicators, Dow Jones- Irwin, Homewood, Illinois 1988.

Cootner, Paul H., ed. The Random Character of Stock Market Prices, Camb6ridge, Mass, MIT Press., 1964.

Cootner, Paul H., 'Stock Prices: Random Vs Systematic Changes' *The Industrial Management Review*, Vol. 13. No.2. Spring 1962.

Copeland, Laurence S. 'Market Efficiency Before and After Crash' *Fiscal Studies*, 1989.

Cowles Alfred, 'Stock Market Forecasting' *The Econometrica*, vol. 12, 1944.

Connor, O' William, 'Stocks, Wheat and Pharaohs' New York: Wener Books Co., 1961.

Dempster Mah, Jones C.M. "Can Technical Pattern Trading be Profitably Automated?", **Working Paper**, Centre for Financial Research, J. I. M. S., University of Cambridge, 1998.

Desai, Meghnath 'Stock Prices, Earnings and Divdends in India – A Quantitative Analysis' *Indian Economic Journal,*. 12, 1965.

Dixit. R.K., 'Behaviour Of Share Prices And Investments In India', Deep and Deep Publications, Rajouri Garden, New Delhi, 1986

Dryden, M., "A source of Bias in Filter Tests of Share Prices.", *Journal of Business*, 42, 1969.

Elliot, Ralph Nelson; Nature's Law-the Secret of the Universe, Elliot, New York, 1946.

Eng. William F., *The Technical Analysis of Stocks, Options Futures*, Irwin, 1988.

Fama Eugene F., "Efficient Capital Markets: A Review of Theory and Empirical Work, "*Journal of Finance*, Vol.25, No.2, May 1970.

Fama, Eugene F., 'Random Walks in Stock Market prices', *Financial Analyst Journal*, 21, 1965.

Fama, Eugene F., "Risk Return and Equilibrium: Some Clarifying Comments", *Journal of Finance* March 1968.

Fama, Eugene F., "The Behaviour of Stock Market Prices.", Journal of Business, 37,   1965.

Fama, Eugene F., Blume Marshall, "Filter Rules and Stock Market Trading," *Journal of Business* Vol. XXXIX January 1966.

Fielitz, Bruce D. and Frederick L. Muller, 'A Simplified Approach to Common Stock Valuation', *Financial Analyst Journal*, 1985.

Fisher, Donald. E, and Ronald J. Jordan, 'Security Analysis and Portfolio Management', Prentice – Hall inc. Eaglewood Cliffs, New Jersey, 1990.

Fogler, Russel H., Analysing the Stock Market-Statistical Evidence and Methodology, 2 ed. Grid Inc., Columbus, Ohio 1978.

Gehm, Fred., 'Who is R.N. Elliot and why is he making waves?', *Financial Analyst Journal*, February, 1983.

Goodinky, Julius, 'Investments' New York: Ronald Press, 1953.

Gupta. L.C., 'Ownership of Industrial Securities in India', *Indian Economic Journal*, 1963.

Gupta. L.C., 'Rates of Return on Equities: Indian Experience,' New Delhi: Oxford University Press, 1981.

Gupta. O.P., 'Behaviour of share Prices in India – A Test of Market Efficiency', National Publishing House, New Delhi, 1985.

Hamburger, Hichael. J And Levis A. Kohen, 'Money and Stock Market Prices: The Channels of Influence', *Journal of Finance,* Vol. XXVII, 1972.

Hardy, Colburn. C., 'Investor's Guide to Technical Analysis', McGraw-Hill Book Co., New York, 1978.

Homa, Kenneth E. and Dwight M. Jaffe, 'The Supply of Money and Common Stock Prices' *Journal of Finance*, Vol. XXVI, December, 1971.

Jack L. Treynor and Fisher Black, "How to Use Security Analysis to Improve Portfolio Selection", *Journal of Business* January 1973.

Jacobs, Bruce I. And Kenneth N. Levy, 'Calendar Anomalies: Abnormal Returns at calendar Turning Points', *Financial Analyst Journal,* 1983.

Jaffe, Jeffrey F., and Robert Winkler, 'Optional Speculation Against an Efficient Market's, *Journal of Finance*, Vol. XXXI. 1976.

Jagadeesh, Narasimhan, "Evidence of predictable Behaviour of Security Returns, "*Journal of Finance*, 1990.

Jensen, Micheal C., Bennington, George A., "Random Walks and Technical Theories: Some Additional Evidence." *Journal of Finance*, 1970.

Johnson, Keity B., 'Stock Splits and Price Changes', *Journal or Finance*, 1966.

Johnson, Thimothy E., 'Investment Principles', Prentice-Hall Inc. Eaglewood, 1978.

Keane, Simon., 'Stock Market Efficiency – Theory, Evidence and Implication', U.K: Oxford, 1983.

King B.F., 'Market and Industry Factors in Stock Price Behaviour' *Journal of Business*, 39, 1966.

Kulkarni. S.N., 'Share Price Behaviour in India: A Spectral Analysis of Random Walk Hypothesis' *The Sankhya*, Vo., 40, 1978.

Lahir M.A and Yakesh Khanna., 'Determinants of Stock Prices in India' *Chartered Accountant*, 1982.

Levy R.A., 'Conceptual Foundations of Technical Analysis' *Financial Analyst Journal*, July – August, 1966, pp. 83-89, Reprinted in Sree Profit. Vol. IV. August, 1989.

Levy Robert A. Random Walks Reality or Myths', *Financial Analyst Journal*, Vol. 23. No. 6 1967.

Levy, Robert A, "The Principle of Portfolio Upgrading," *The Industrial Management Review* , 1967.

Levy, Robert A, "Relative Strength as a Criterian For Investment Selection.", *Journal of Finance,* 22, 1967.

Levy, Robert A, "The Predictive Significance of Five Point Chart Patterns.", *Journal of Business*, 44, 1971.

Levy, Robert A., "An Evaluation of Selected Applications of Stock Market Timing Techniques, Trading Tactics and Trend Analysis," Ph.D Dissertation, the American University, 1966.

Lorie, James H. and Hamilton, Mary t., The Market: Theories and Evidence, Homewood Illinois: Richard D Irwin Inc., 1973.

Lorie, James H., 'Public policy for American Capital Market', Washington D.C., U.S. Dept. of Treasury, 1974.

Lukac, L.P., Brorsen,B.W. and Irwin, S.H.,"A Test of Futures Market Disequilibrium Using Twelve Different Technical Trading Systems.", *Applied Economics,* 1988.

Lukac, L.P.and Brorsen, B.W.,"A Comprehensive Test of Futures Market Disequilibrium.", *Financial Review,* 1990.

M.R. Mayya, "Reflections on the Changing Scenario of the Indian Stock Markets", **Working Paper**, Bombay: AD Schroff Memorial Trust, 1995.

Magee, John and Edwards, Robert D, 'Technical Analysis of Stock Trends', John Magee, Boston, Massachusetts, the USA.

Malkiel, Burten C., 'Is the Stock Market Efficient?' *Science,* 243, 1989.

Mandelbrot, B., "Forecasts of Future Prices, Unbiased Market, and Martingale'Models.", *Journal of Business,* 1966.

Mandelbrot, B., "The Variation of Certain Speculative Prices.", *Journal of Business,* 1963.

Mansukhani G.R., 'Golden Investment Strategy', Bombay, Lalvani Publishing House, 1968.

Mao, James. C.T., 'The Valuation of Growth Stocks: the Investment Opportunities Approach' *Journal of Finance,* 1966.

Murphy, J. Austin, "Futures Fund Performance: A Test of the Effectiveness of Technical Analysis," *Journal of Futures Markets,* Summer 1986.

Olson, Dennis., "Have Trading Rule Profits in the Currency Markets Declined Over Time?", *Journal of Banking and Finance,* 28, January 2004.

Osler, C.L., "Identifying noise traders: the head-and-shoulders pattern in U.S. equities", Federal Reserve Bank of New York **Working Paper** 1998.

Pandey,I.M. and Bhat R., "Efficiency Market Hypothesis: Understanding and Acceptance in India", **National Seminar of Indian Securities Market: Thrust and Challenges,** University of Delhi, 1988.

Peter W. Aan, Futures, January 1985.

Plummer, Tony, Forecasting Financial Markets-the Truth Behind Technical Analysis, Kogan Page Ltd., London, 1989.

Prasanna Chandra, 'Valuation of Equity Shares in India', Sultan Chand & Sons, New Delhi, 1977.

Prechter, Robert R.(ed). The Major Works of R.N. Elliot, New Classics Library, New York, 1980.

Pring J., Martin, `Technical analysis explained' McGraw-Hill, 1991.

Pruitt, Stephen W., and Richard E. White, "The CRISMA Trading System: Who says Technical Analysis Can't Beat the Market?" *Journal of Portfolio Management*, Spring 1998.

Rao, Krishnan N. and Mukherjee, K., "Random Walk Hypothesis: 'An Empirical study", *Arthanithi*, XIV, 1971.

Ready, M.J., 'Profits from Technical Trading Rules.", *Financial Management*, 31, 2003.

Rhea, Robert, Dow Theory, Barrons, New York, 1932.

Robert Ferguson, "Active Portfolio Management-How to Beat the Index Funds", *Financial Analysts Jouranal*, June 1975.

Robins, Sidney, 'The Securities Market', New York, Free Press, 1966.

Roll, Richard, Review "The Efficient Market Model Applied to US Treasury Bill Rates." Ph.D dissertation, University of Chicago, 1968.

Samuelson, Paul A., "Proof that Properly Anticipated Prices Fluctuate Randomly," *Industrial Management Review* Vol.6 Spring, 1965.

Sharma, J. L. and Kennedy E., "A Comparative Analysis of Stock Price Behaviour on the Bombay, London and New York Stock Exchanges.", *Journal of Financial and Quantitative Analysis*, 1977.

Skouras, S., "Financial Returns and Efficiency as Seen by an Artificial Technical Analysts.", *Journal of Economic Dynamics & Control*, 25, 2001.

Solamon, Ezra, 'The Theory of Financial Management', New York: Columbia University, Press, 1963.

Stevenson, R.A. and Bear, R.M., "Commudity Futures: Trends or Random Walks?", *Journal of Finance*, 25, 1970.

Sweeney, R.J. and Surajaras, P, "The Stability of Speculative Profits in the Foreign Exchanges.", A Reappraisal of of the Efficiency of Financial Markets, ed., R.M.C. Guimaaes and others, Heidelberg: Springer,-Verlag, 1989.

Sweeny, R.J., "Beating the Foreign Exchange Market.", *Journal of Finance*, 41, 1986.

Sweeny, R.J., "Some New Filter Rule Tests: Methods and Results.", *Journal of Financial and Quantitative Analysis*, 23, 1988.

Taylor, Mark P.and Allen H., "The Use of Technical Analysis in the Foreign Exchange Market", *Journal of International Money and Finance*, 1992.

Teylor, S.J., "Stock Index and Price Dynamics in the UK and the US: New evidence from a Trading Rule and Statistical Analysis", *European Journal of Finance*, 6, 2000

The Wall Street Journal, editorials various issues, 1900-1929.

Treynor, Jack L., and Ferguson Robert, 'In Defence of Technical Analysis', *Journal of Finanace*, July 1985.

Van Horne,J.C., and Parker G.G. C., "The Random-Walk Theory: An Emperical Test.", *Financial Analysts Journal*, 23, 1967.

Yalaguresh, Yalwar B, "Bombay Stock Excahge: Rates of Return and Efficiency.", *Journal of Banking and Finance*, 1983.

Ying C.C., "Stock Market Prices and Volumes of Sales", *Econometrica* July 1966.

DEFINITIONS OF TERMS USED

The following terms used in this study have been taken in the following meaning.

Bottom- It is the lowest price formed when a decline reverses up

Buy and hold Strategy – It is the non-signal strategy where the investor buys a stock and holds it without reference to any signal or speculative motive. There is no intervening sale or purchase for profit. Usually genuine investors resort to this. The return in this case is calculated assuming a sale at the end of the period taken for analysis. It is a terminal strategy.

Daily - Means every day action. It may be according to the signals from analysis or without using any signal from any type of analysis.

Daily long strategy - It means the trader buys a stock in opening hours of trade and sells it in the closing hours. Bulls do it as they always expect a price rise. It may be done by using signals or without using signals from analysis. If it is without using any signal from analysis, it termed as 'Daily Long Only'

Daily Short strategy - It means the trader sells a stock in opening hours of trade and buys it back in the closing hours. Bears do it as they always expect a price decline. It may also be done using signals or without using signal from analysis. If it is without using any signal from analysis, it termed as 'Daily Short Only'

Experimental - It means that which relates to the period of experiment or experimental analysis. In this study it is the period of seven years from 01-01-1990

to 31-12-1996. So experimental period return or wealth means return or wealth obtained during the period this seven years.

Filter- It means any additional change required in the price or indicator value for confirming the signals there from. In this study, filters are never used

Long Only – These terms are used in the study to indicate the Daily Long strategy without using any signal and which is done every day without exception throughout the period of analysis.

Long- Short- it is a combination of the 'long-cash strategy' and 'short-cash strategy'. Therefore, the trader is always 'in the market' either by his long position or by his short position.

Long-Cash – It is a signal strategy where the trader buys the stock when the analysis triggers a 'buy signal' and sells it when a 'sell signal' is given by the analysis. He holds the stock from the 'date of buy signal' to the 'date of sell signal. From the 'date of sell signal to the 'date of (next) buy signal' he is out of the market and holds the cash.

Lower Boundary- It is the line that connects two or more Bottoms

Mean return – It means the terminal geometric mean return for each stock at the end seven years. It is the value of "nth root of the quotient obtained by dividing the terminal wealth by the initial wealth as reduced by one", where 'n' is the number of years (7) in the analysis *(GM= (nth root (fv/pv))-1)*

Non-signal strategy – It is that strategy which does not take into account the result or signals from any analysis.

Quarterly Terminal wealth – The terminal wealth simulated at the end of every quarter irrespective of the prevailing 'in the market' position. It shows how much an investment of Rs.100/- made at the beginning of the quarter has grown to at the

end of the quarter. There shall be twentyeight (28) quarterly wealth figures in each of the experimental and testing period. It is based longitudinal approach.

Reversal Day -The day on which, but after the breakout, the price made a reversal of its move that was prevailing at breakout.

Reversal –It means the retreat of price from the prevailing direction

Return for a completed transaction- It stands for rate of return per 'a completed transaction'. It is obtained when the 'net return' is expressed to the base of the 'cost of commitment'.

Return- Annual return is one of the two criteria used to evaluate various strategies. It is Geometric mean based on future value of investment at the end of seven years.

Short -Cash – It is a signal strategy where the trader first sells the stock when the analysis triggers a 'sell signal' and buys it back when a 'buy signal' is given by the analysis. He never holds the stock. From the 'date of sell signal to the 'date of buy signal', he is 'in the market' in respect of his short position. From the 'date of buy signal' to the 'date of (next) sell signal' he is out of the market and holds the cash.

Short Only – These terms are used in the study to indicate the Daily Short strategy without using any signal and which is done every day without exception throughout the period of analysis.

Signal Strategy –The strategy in which decisions to enter and exit the market, are strictly triggered by signals from technical analysis.

Strategy- It is the base on which investment decision (buy or sell) is taken.

Terminal – It means after a gap of time of periods or at the end of a period not less than a day. In a signal strategy, it means act only on the next day following the date of signal and no action on any other day or days intervening signals. It is

done usually by investors who believe in the futurity of analysis and wants to reduce the number of their deals, may be because of transaction cost.

Terminal wealth- The market value, at the end of the period, of an investment made at the beginning of the period concerned.

Testing- It means replication of experiment for the purpose of ascertaining the consistency of the results of experiment.

Testing Period - It is the period during which experimental results are replicated. In this study it covers the period from 01-01-1997 to 31-12-2003. In the sense of replication, it is 'out of sample period'.

Top- It is the highest price formed when a rally reverses down

Trigger – It means the point in the value of a technical indicator or an analysis tool reaching which or crossing of which, generates a signal to buy or sell. In this study triggers of varying sizes are used for the simulation of deals in the case of Indicators.

Upper Boundary- It is the line that connects two or more tops

Wealth –It is the realisable value of holdings, obtained by simulation of historical data.
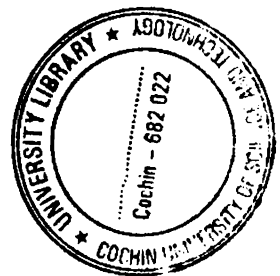
Stock Exchange, reveals is the persistence of relative strength of individual stocks in the market.[17]

The Efficient Market Hypothesis is in sharp contrast with both the analytical approaches to security evaluation. The market in which stock prices always fully reflect all available information has been termed as efficient market by its protagonists. It states that the expected price of a security one period hence, given today's set of information, is equal to today's price compounded at some desired return commensurate with the risk level of the security. In other words, today's price is the best estimate of tomorrow's price after present valuing tomorrow's price at the appropriate rate of return.[18] Thus in an efficient market stock prices respond rapidly and accurately to all relevant and available information. The advocates of EMH hold that, in a free and competitive market, the market prices would fully and rapidly reflect all the information available in the market. Information, affecting positively and negatively the value of a stock, generate randomly in the market and hence price changes also occur so randomly. As new information enters the market the price will adjust to reflect the new intrinsic value implied by the new information. If a piece of information about a security is predictable, that information will be incorporated into the price of the security. When the predicted event occurs, there shall be little change in the price as the price had already allowed for the event. Hence in such a market it will be exceedingly difficult for the participants to consistently earn a superior return (than that from a random buy-and-hold strategy) merely from the analysis of such adjusted factors. Therefore, they claim that, in an efficient market the current price of a security would be a good estimate of its intrinsic value. The difference, if any, is attributed to the

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[17] Levy, Robert A. "Relative Strength as a Criterion for Investment Selection." Journal of Finance, Vol. xxii, (December-1967), PP. 595-610.

[18] (i) Fama Eugene F., "Efficient Capital Markets: A Review of Theory and Empirical Work, "Journal of Finance, Vol.25, No.2, (May 1970), PP. 383-417.

(ii) Lorie, James H. and Hamilton, Mary t., The Market: Theories and Evidence, Homewood Illinois: Richard D Irwin Inc., (1973).

(iii)Fogler, Russel H., Analysing the Stock Market-Statistical Evidence and Methodology, 2 ed. Grid Inc., Columbus, Ohio (1978), P.1.