

**TESTING ALPHA RETURNS IN EQUITY INDICES: A
POST RECESSION ANALYSIS OF BRICS**

Thesis Submitted for the Award of the Degree of

DOCTOR OF PHILOSOPHY

IN

COMMERCE

By

POOJA JAIN

Registration Number: 41900030

Supervised By

Dr. Nitin Gupta

(Professor)

Mittal School of Business

Lovely Professional University



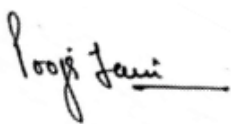
Transforming Education Transforming India

LOVELY PROFESSIONAL UNIVERSITY, PUNJAB

2023

DECLARATION

I, hereby declared that the presented work in the thesis entitled “**Testing Alpha Returns in Equity Indices: A Post Recession Analysis of BRICS**” in fulfilment of degree of **Doctor of Philosophy (Ph. D.)** is outcome of research work carried out by me under the supervision of Dr. Nitin Gupta, working as Professor, in the Mittal School of Business of Lovely Professional University, Punjab, India. In keeping with general practice of reporting scientific observations, due acknowledgements have been made whenever work described here has been based on findings of other investigator. This work has not been submitted in part or full to any other University or Institute for the award of any degree.



(Signature of Scholar)

Name of the scholar : Pooja Jain
Registration No. : 41900030
Department/school : Mittal School of Business
Lovely Professional University,
Punjab, India

CERTIFICATE

This is to certify that the work reported in the Ph. D. thesis entitled “**Testing Alpha Returns in Equity Indices: A Post Recession Analysis of BRICS**” submitted in fulfillment of the requirement for the award of degree of **Doctor of Philosophy (Ph.D.)** in the Mittal School of Business, is a research work carried out by Pooja Jain, 41900030, is bonafide record of his/her original work carried out under my supervision and that no part of thesis has been submitted for any other degree, diploma or equivalent course.



(Signature of Supervisor)

Name of supervisor : Dr. Nitin Gupta
Designation : Professor
Department/school : Mittal School of Business
University : Lovely Professional University

ABSTRACT

Introduction

Technical analysis is an approach for forecasting the movements of the future prices after properly identifying the trends in prices and volumes. Technical analysis usually makes the graphs of the past prices and then tries to find out the patterns so that the future can be predicted to the great extent. Technical Analysis always draws the attention of economists as its pertinency put doubt upon the Efficient Market Hypothesis (EMH) which states that market prices 'immediately and fully reflect all material information. The Dow Theory plant the basis for what was next to become modern technical analysis. Dow Theory was not presented as one complete amalgamation, but rather compiled from the writings of Charles Dow over many years. We include Dow theory, Charts, Support and Resistance level, Moving Average, Odd lot trading, short selling Theory, Volume of trade, Fibonacci Number, Stochastic, Ralph Nelson Elliott Wave Theory, Oscillators and Filter rules in technical analysis. Oscillation means an evolution of certain items repeatedly on the same path with the same frequency, like that of a pendulum in a wall clock. The prominent or important oscillators are following trend analysis of selected companies under study with their monthly average closing stock prices.

- Moving Average Convergence and Divergence (MACD)
- Rate of Change (ROC)
- Relative Strength Index (RSI)

BRICS is an acronym for Brazil, Russia, India, China, and South Africa. South Africa was added to the list in 2010. Brazil, Russia, India, China, and South Africa ranked among the world's fastest-growing emerging market economies for years.

Research Methodology:

Research Gap: -

1. After reviewing the literature, we have found that most of the work related to technical analysis is mainly conducted on developed markets.

2. There is also no study found that has been conducted on BRICS. So, the study may probably be the first, to make an analysis in the BRICS.
3. The studies that are conducted are only limited to find out the predicting ability of technical analysis and none has found out the excess returns generated by the technique of technical analysis. This may probably be the first attempt to find out the excess return i.e., alpha return.

Objectives of the study

1. To study the effectiveness of Exponential Moving Average (EMA) for predicting the equity indices of BRICS.
2. To examine the efficiency of Exponential Moving Average (EMA) in generating alpha returns.
3. To study the effectiveness of Relative Strength Index (RSI) in equity indices of BRICS.
4. To evaluate comparative analysis of Alpha returns on BRICS.

Hypothesis:

To achieve the objectives in an effective manner, the following hypothesis were framed:-

H₁: The return of active strategy using EMA 5-20 is either less than or equal to the return given by the passive strategy in any of the selected markets.

H₂: The return of active strategy using EMA 5-50 is either less than or equal to the return given by the passive strategy in any of the selected markets

H₃: The return of active strategy using EMA 5-100 is either less than or equal to the return given by the passive strategy in any of the selected markets

H₄: The return of active strategy using EMA 5-200 is either less than or equal to the return given by the passive strategy in any of the selected markets

H₅: The return of active strategy using RSI is either less than or equal to the return given by the passive strategy in any of the selected markets.

H₆: There is no significant difference in the Alpha Returns among BRICS. The following sub null hypothesis are created:-

H₀₁:- There is no significant difference in Alpha returns on the basis of technique used by the technical analysis.

H₀₂:- There is no significant difference in Alpha returns in different markets by the using technical analysis.

H₀₃:- There is no significant difference in Alpha returns among blocks using a specific technique of Technical analysis.

Data Collection

In the present study, only secondary data has been used. Secondary data was collected from the website of www.finance.yahoo.com as on 19th October, 2020. The date is important to mention as the data tend to change from one date to another date by the data provider. The researcher has tried to verify the collected data from other websites. The researcher has verified the data with www.investing.com so that there will be no doubt with regard to the authenticity of the data.

Techniques: -

The present study has verified the theories of technical analysis on the basis of observations. So, it is empirical by nature. It has examined the profitability of indexes with the help of CAGR, Correlation, Alpha ratio, Sharpe ratio and Brock t statistics. So, it is analytical by nature. To check the effectiveness, the researcher has used five techniques of technical analysis i.e., EMA5-20, EMA5-50, EMA5-100, EMA5-200 and RSI.

Findings: -

Major Findings

Examining the Effectiveness of technical analysis using EMA: In the present study, to examine the Effectiveness of technical analysis two most prominent techniques of technical analysis have been used which are Exponential Moving

Average and Relative Strength Index. Both of these techniques have been used on BRICS market. The major findings while using these techniques are as follows: -

Major findings for the complete period: EMA are used on complete set of data in four ways i.e., EMA 5-20, EMA 5-50, EMA 5-100 and EMA 5-200.

- While using EMA 5-20, on the whole period set of data it has been found the EMA 5-20 has its significant presence in Russian market.
- While using EMA 5-50, on the whole period set of data it has been found the EMA 5-50 has its significant presence in Russian market.
- While using EMA 5-100, on the whole period set of data it has been found the EMA 5-100 has not shown any significant results in any of the markets under study.
- While using EMA 5-200, on the whole period set of data it has been found the EMA 5-200 has not shown any significant results in any of the markets under study.

Major findings for first sub-period: The first sub-period starts from 1st April 2008 and ends on 31st March, 2012. In this period too all EMA which are discussed earlier are used and major findings are as follows:

- While using EMA 5-20, on this sub period set of data it has been found the EMA 5-20 has its significant presence in Russian and Chinese market.
- While using EMA 5-50, on this sub period set of data it has been found that EMA 5-50 has its significant presence in Russian market.
- While using EMA 5-100, on this sub period set of data it has been found the EMA 5-100 has shown any significant results only for Chinese market.
- While using EMA 5-200, on this sub period set of data it has been found the EMA 5-200 has not shown any significant results in any of the markets under study.

Major findings for second sub-period: The second sub-period starts from 1st April 2012 and ends on 31st March, 2016. In this period too all EMA which are discussed earlier are used and major findings are as follows:

- While using EMA 5-20, on this sub period set of data it has been found the EMA 5-20 has its significant presence in Russian market.
- While using EMA 5-50, on this sub period set of data it has been found the EMA 5-50 has not shown any significant results in any of the markets under study.
- While using EMA 5-100, on this sub period set of data it has been found the EMA 5-100 has not shown any significant results in any of the markets.
- While using EMA 5-200, on this sub period set of data it has been found the EMA 5-200 has not shown any significant results in any of the markets under study.

Major findings for third sub-period: The third sub-period starts from 1st April 2016 and ends on 31st March, 2020. In this period too all EMA which are discussed earlier are used and major findings are as follows:

- While using EMA 5-20, on this sub period set of data it has been found the EMA 5-20 has not shown any significant results in any of the markets under study.
- While using EMA 5-50, on this sub period set of data it has been found that EMA 5-50 has not shown any significant results in any of the markets under study.
- While using EMA 5-100, on this sub period set of data it has been found that EMA 5-100 has not shown any significant results in any of the markets.
- While using EMA 5-200, on this sub period set of data it has been found that EMA 5-200 has not shown any significant results in any of the markets under study.

Major findings from markets point of view: When the data is analysed for all the markets under study it has been found that out of all markets Russian markets shows the greatest presence of EMA. South African, Indian and Brazilian market never show any of the significant result whereas Chinese market has shown significant results in some case.

Examining the Effectiveness of technical analysis using RSI:

- While using RSI on the whole period data it has been found that it has generated statistically significant results in case of Russian market. Remaining four markets have not generated any of the significant results using RSI for this time period.
- While using RSI on the first sub period data it has been found that it has generated statistically significant results in case of Russian market. Remaining four markets have nor generated any of the significant results using RSI for this time period.
- While using RSI on the second sub period data it has been found that it has generated statistically significant results in case of Russian market. Remaining four markets have nor generated any of the significant results using RSI for this time period.
- While using RSI on the third sub period data it has been found that it has not generated statistically significant results in any of the selected market.

Examining the efficiency of technical analysis using EMA: In the present study, in order to find out the efficiency of the markets, the researcher has used alpha ratio. Alpha ratio is calculated by taking the difference of net returns generated by the techniques used in the selected market with the returns generated by passive strategy i.e., return generated by the index.

Major findings for the complete period: EMA is used on complete set of data in four ways i.e., EMA 5-20, EMA 5-50, EMA 5-100 and EMA 5-200.

- While using EMA 5-20 on the complete data set, we found that out of the five markets four have generated positive alpha returns. Only South African market have generated negative alpha return for the period.
- While using EMA 5-50 on the complete data set, we found that out of the five markets four have generated positive alpha returns. Only South African market have generated negative alpha return for the period.

- While using EMA 5-100 on the complete data set, we found that out of the five markets three have generated positive alpha returns. Chinese and South African markets have generated negative alpha return for the period.
- While using EMA 5-200 on the complete data set, we found that out of the five markets three have generated positive alpha returns. Chinese and South African markets have generated negative alpha return for the period.

Major findings for first sub-period: The first sub-period starts from 1st April 2008 and ends on 31st March, 2012. In this period too all EMA which were discussed earlier are used and major findings are as follows:

- While using EMA 5-20 on this sub period data set, we found that out of the five markets four have generated positive alpha returns. Only South African market have generated negative alpha return for the period.
- While using EMA 5-50 on this sub period data set, we found that out of the five markets four have generated positive alpha returns. Only South African market have generated negative alpha return for the period.
- While using EMA 5-100 on this sub period data set, we found that all five markets have generated positive alpha returns.
- While using EMA 5-200 on this sub period data set, we found that out of the five markets four have generated positive alpha returns. Chinese market has generated negative alpha return for the period.

Major findings for second sub-period: The second sub-period starts from 1st April 2012 and ends on 31st March, 2016. In this period too all EMA which were discussed earlier are used and major findings are as follows:

- While using EMA 5-20 on this sub period data set, we found that out of the five markets three have generated positive alpha returns. Indian and South African markets have generated negative alpha return for the period.
- While using EMA 5-50 on this sub period data set, we found that out of the five markets two markets have generated positive alpha returns. Indian, Chinese and South African markets have generated negative alpha return for the period.

- While using EMA 5-100 on this sub period data set, we found that out of the five markets only one market has generated positive alpha returns. Brazilian, Indian, Chinese and South African markets have generated negative alpha return for the period.
- While using EMA 5-200 on this sub period data set, we found that all five markets three have generated positive alpha returns. The negative returns are generated by Brazilian, Indian and South African market.

Major findings for third sub-period: The third sub-period starts from 1st April 2016 and ends on 31st March, 2020. In this period too all EMA which were discussed earlier are used and major findings are as follows:

- While using EMA 5-20 on this sub period data set, we found that out of the five markets two have generated positive alpha returns. Brazilian, Chinese and South African markets have generated negative alpha return for the period.
- While using EMA 5-50 on this sub period data set, we found that out of the five markets two markets have generated positive alpha returns. Russian, Chinese and South African markets have generated negative alpha return for the period.
- While using EMA 5-100 on this sub period data set, we found that out of the five markets three markets have generated positive alpha returns. Chinese and South African markets have generated negative alpha return for the period.
- While using EMA 5-200 on this sub period data set, we found that all five markets three have generated positive alpha returns. The negative returns are generated by Russian market and Chinese market.

Major findings from markets point of view: Out of all the markets taken for the study it has been found that Russian market is most predictable out of five markets. In most of the time period the alpha returns generated by Russian market is found to be positive. In some cases, the alpha returns generated by Russian market is highest out of all five markets. South African market mostly show negative alpha returns. Remaining three markets i.e., Indian market, Chinese market and Brazilian market have shown the mixes results i.e., shows positive alpha returns in some cases and in some cases negative alpha returns.

Examining the efficiency of technical analysis using RSI:

- While using RSI for the complete data set for calculating the alpha returns it has been found that out of five markets three markets have generated negative alpha returns. The highest returns are generated by Russian market followed by Indian market.
- While using RSI for the first sub period data set for calculating the alpha returns it has been found that out of five markets three markets have generated negative alpha returns. The highest returns are generated by Russian market followed by Indian market.
- While using RSI for the second sub period data set for calculating the alpha returns it has been found that out of five markets only one market has generated negative alpha returns i.e., South African market. The highest returns are generated by Russian market followed by Chinese market.
- While using RSI for the third sub period data set for calculating the alpha returns it has been found that out of five markets three markets have generated negative alpha returns. The highest returns are generated by Indian market.

Testing alpha return among markets: While testing the alpha returns on the different market the researcher has used ANOVA technique. It has been found that alpha returns of different markets were statistically different.

Testing alpha return among different sub periods: While testing the alpha returns on the different sub periods the researcher has used ANOVA technique. It has been found that alpha returns of different sub periods were not statistically different.

5.3 Recommendations: The present research on technical analysis has put every effort to find out the application of technical analysis on the worldwide exchanges. Some of the recommendations on the basis of the findings of the present research are as follows: -

- Our findings suggest that further empirical research on the shorter period of moving average can be conducted, which may provide further insights.

- Our findings also observed that the application of technical analysis is not same for every period of time. So, the proper entry and exit must be considered while using technical analysis.
- Only one or two techniques are not good to use every time for prediction point of view. So, more techniques must be used to get better insights to a particular market.

The present work done on BRICS has tried to find out the application of some of the most popular techniques of technical analysis. The researcher has tried each possible effort to get the maximum clarification and relation of the techniques with all the markets.

ACKNOWLEDGEMENT

Research is a corporate activity in which co-ordination, encouragement, co-operation, help and assistance is required from many sources, which I have received in ample measures. Hence my gratitude is to all those concerned individually although it can be never be enough, when compared to what I received from them. This research work is an acknowledgement to the human resource competence of many individuals, who have contributed to this work successfully.

I owe a huge amount of gratitude to a large number of people who have inspired and helped me in the fulfilment of this thesis and without whose unstinting and timely help this thesis would not have been ‘this’ thesis.

At the first instance I wish to acknowledge with profound sense of appreciation, help and support, which I received from my guide Dr Nitin Gupta, Professor, Mittal School of Business, Lovely Professional University. I express my sincere gratitude to Dr. Nitin Gupta supervisor for his guidance, support and insightful comments throughout the research work.

I am equally grateful to Dean of Lovely Professional University for his vital advices and encouragement. Both of them have guided me through every step of this work. Their timely inputs and response never made me loose the track of the work. I am also thankful to my doctoral committee members for their suggestions and continuous monitoring of my research work. My “thanks” are also due to the office staff of the Lovely Professional University for their constant support and assistance. My sincere thanks to my co-scholars for their support in carrying out the research.

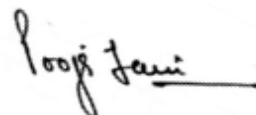
I owe a huge debt to Dr Tejinder Sharma, Professor, Department of Commerce, Kurukshetra University Kurukshetra for his inspiration and teaching and for channelizing my career to research.

I am also grateful to Dr Abha Bansal (Principal) and Prof Mukesh Trehan (Head of Department of Commerce) of S.A Jain (PG) College, Ambala City affiliated to Kurukshetra University Kurukshetra for their persistent support.

Without family support I cannot achieve my dreams in my life, so I am here beholden respected Late Sh. Varinder Kumar Malik (Father), Smt. Varsha Malik (Mother), Sh. Varinder Kumar Jain (Father-in-law), Smt. Promila Jain (Mother-in-law), Jiya Jain & Saksham Jain (Children), Mr. Sumit Malik and Mr. Nitin Malik (Brothers), all of them, all of them have been a source of incessant motivation and encouragement to me and who always extended their support to me in completing this research work. I am deeply indebted to you for all your encouragement and support throughout my endeavour.

I am immensely happy to thank my spouse, Mr Hemant Jain for continually acting as the support system on which I have often banked and also for their affectionate cooperation & silent sacrifice in this work. I want to owe this success to the man who is not only my husband but a person without whom nothing would have been possible. Thank you for backing me each day.

At last, my heartiest gratitude to the almighty who blessed and enabled me to complete my work. I pray him to pour great success on my path and enlighten me further.

A handwritten signature in black ink that reads "Pooja Jain" with a horizontal line extending to the right.

Pooja Jain

TABLE OF CONTENTS

CHAPTER -1	INTRODUCTION	24-63
1.1	Origins	24
1.2	Technical Analysis	26
1.3	Conjectures used in Technical Analysis	27
1.4	Efficient Market Hypothesis (EMH)	28
1.5	Criticism and behavioral finance	30
1.6	EMH and Technical Analysis	33
1.7	Basis of Technical Analysis	34
1.7.1	Everything is discounted in price	34
1.7.2	Price changes are not entirely arbitrary	35
1.7.3	Why is less significant than "WHAT"?	35
1.8	Price Fields	36
1.9	Fundamental data comes before technical analysis	37
1.10	Technical analysis methods, instruments, or indicators	37
1.10.1	Dow theory	38
1.10.1.1	Dow Theory explanation	38
1.10.1.1.1	Primary Trend	38
1.10.1.1.2	Secondary Trend	39
1.10.1.1.3	Minor Trends	39
1.10.2	Charts	39
1.10.2.1	Line chart	41
1.10.2.2	Bar Chart	42
1.10.2.3	Point and Figure chart	42
1.10.2.4	Candle stick chart	42
1.10.3	Support and Resistance Level	42
1.10.4	Moving Average Method	43
1.10.5	Fibonacci numbers	45
1.10.6	Odd lot trading	45
1.10.7	Volume of trade	46
1.10.8	Short sales	46

1.10.9	Stochastic	46
1.10.10	“Ralph Nelson Elliott wave theory”	48
1.10.10.1	Degree	50
1.10.10.2	Wave Signature and Behavioural traits	50
1.10.10.3	A five wave structure (dominant trend)	51
1.10.10.4	“Three Wave pattern (corrective trend)”	52
1.10.11	Oscillators	52
1.10.11.1	Moving Average Convergence and Divergence (MACD)	53
1.10.11.1.1	Enhanced signals using the MACD	53
1.10.11.2	Rate of Change (ROC)	54
1.10.11.2.1	Advance signals with ROC assistance	54
1.10.11.3	Relative Strength Index (RSI)	54
1.10.11.3.1	Using the RSI to create signals	55
1.10.12	Filter rules	55
1.11	Recognizing the pattern and trend	56
1.11.1	Head and Shoulders	56
1.11.2	Cup and Handle	57
1.11.3	Double Tops and Bottoms	57
1.11.4	Triangles	58
1.11.5	Flag and Pennant	59
1.11.6	Wedge	60
1.11.7	Gaps	61
1.11.8	Triple Tops and Bottoms	61
1.11.9	Rounding Bottom	62
CHAPTER- 2	REVIEW OF LITERATURE	64-91
CHAPTER- 3	RESEARCH METHODOLOGY	92-98
3.1	Need of the present study	92
3.2	Scope/area of the study	93
3.3	Profile of the markets & indices	93
3.3.1	Bm&f Bovespa (IBOVESPA) (Brazil)	94

3.3.2	Russian Trading System (RTS) (Russia)	94
3.3.3	S&P CNX nifty (NIFTY) (India)	94
3.3.4	Shanghai Stock Exchange (SSE) (China)	95
3.3.5	FTSE/JSE Limited (JSE) (South Africa)	95
3.4	Objectives of the study	96
3.5	Research design	96
3.5.1	Sampling design (Population, Sample size and Sampling technique)	97
3.5.2	Nature, Sources and Collection of data	97
3.5.3	Time period of the study	97
3.6	Chapter wise scheme of the study	97
3.7	Hypothesis	98
3.8	Statistical techniques/tools used	99
3.8.1	Exponential Moving Average (EMA)	99
3.8.2	Relative Strength Index (RSI)	100
3.9	Limitations of the study	101
3.10	Format of writing Bibliography	101
CHAPTER- 4	ANALYSIS AND INTERPRETATION	102-171
CHAPTER- 5	FINDINGS, RECOMMENDATIONS, SUGGESTIONS AND IMPLICATIONS	172-183
5.1	Profile, Objectives, Hypothesis and Methodology	172
5.1.1	Description of the markets & indices	172
5.1.2	Research Objectives	172
5.1.3	Research Hypothesis	173
5.1.4	Data and Tools used in the research	173
5.2	Major Findings	174
5.2.1	Examining the Effectiveness of technical analysis using EMA	174
5.2.1.1	Major findings for the complete period	174
5.2.1.2	Major findings for first sub-period	175
5.2.1.3	Major findings for second sub-period	176

5.2.1.4	Major findings for third sub-period	176
5.2.1.5	Major findings from markets point of view	177
5.2.2	Examining the Effectiveness of technical analysis using RSI	177
5.2.3	Examining the efficiency of technical analysis using EMA	177
5.2.3.1	Major findings for the complete period	178
5.2.3.2	Major findings for first sub-period	178
5.2.3.3	Major findings for second sub-period	179
5.2.3.4	Major findings for third sub-period	180
5.2.3.5	Major findings from markets point of view	180
5.2.4	Examining the efficiency of technical analysis using RSI	181
5.2.5	Testing alpha return among markets	181
5.2.6	Testing alpha return among different sub periods	181
5.3	Conclusion	181
5.4	Recommendations	182
5.5	Suggestions	183
5.6	Implications	183
	References	184-195
	Appendices	196-201

LIST OF TABLES

Table No.	Title	Page No.
3.1	Countries with their respective indices	93
4.1	Part I: - In this part the descriptive analysis of data is done Descriptive Statistics for all markets (Whole Sample Period i.e., from 1 st April 2008 to 31 st March 2020)	103
4.2	Descriptive Statistics for all markets (Sub Sample Period i.e., from 1 st April 2008 to 31 st March 2012)	104
4.3	Descriptive Statistics for all markets (Sub Sample Period i.e. from 1 st April 2012 to 31 st March 2016)	105
4.4	Descriptive Statistics for all markets (Sub Sample Period i.e. from 1 st April 2016 to 31 st March 2020)	106
4.5	Part II: - In this part the effectiveness of all techniques taken in the study is analyzed “Outcomes for EMA 5-20 Technical Trading Rules” “(Panel I: From 1 st April 2008 to 31 st March 2020)”	107
4.6	“Outcomes for EMA 5- 20 Technical Trading Rules” “(Panel II: From 1 st April 2008 to 31 st March 2012)”	109
4.7	“Outcomes for EMA 5- 20 Technical Trading Rules” “(Panel III: From 1 st April 2012 to 31 st March 2016)”	110
4.8	“Outcomes for EMA 5- 20 Technical Trading Rules” “(Panel IV: From 1 st April 2016 to 31 st March 2020)”	112
4.9	“Outcomes for EMA 5- 50 Technical Trading Rules” “(Panel I: From 1 st April 2008 to 31 st March 2020)”	113
4.10	“Outcomes for EMA 5- 50 Technical Trading Rules” “(Panel II: From 1 st April 2008 to 31 st March 2012)”	114
4.11	“Outcomes for EMA 5- 50 Technical Trading Rules” “(Panel III: From 1 st April 2012 to 31 st March 2016)”	116
4.12	“Outcomes for EMA 5- 50 Technical Trading Rules” “(Panel IV: From 1 st April 2016 to 31 st March 2020)”	117
4.13	“Outcomes for EMA 5- 100 Technical Trading Rules” “(Panel I: From 1 st April 2008 to 31 st March 2020)”	118
4.14	“Outcomes for EMA 5- 50 Technical Trading Rules” “(Panel II: From 1 st April 2008 to 31 st March 2012)”	119
4.15	“Outcomes for EMA 5- 50 Technical Trading Rules” “(Panel III: From 1 st April 2012 to 31 st March 2016)”	120
4.16	“Outcomes for EMA 5- 50 Technical Trading Rules” “(Panel IV: From 1 st April 2016 to 31 st March 2020)”	121
4.17	“Outcomes for EMA 5- 200 Technical Trading Rules” “(Panel I: From 1 st April 2008 to 31 st March 2020)”	122

4.18	“Outcomes for EMA 5- 200 Technical Trading Rules” “(Panel II: From 1 st April 2008 to 31 st March 2012)”	123
4.19	“Outcomes for EMA 5- 200 Technical Trading Rules” “ “(Panel III: From 1 st April 2012 to 31 st March 2016)”	124
4.20	“Outcomes for EMA 5- 200 Technical Trading Rules” “(Panel IV: From 1 st April 2016 to 31 st March 2020)”	125
4.21	“Outcomes for RSI Technical Trading Rules” “(Panel I: From 1 st April 2008 to 31 st March 2020)”	127
4.22	“Outcomes for RSI Technical Trading Rules” “(Panel II: From 1 st April 2008 to 31 st March 2012)”	128
4.23	“Outcomes for RSI Technical Trading Rules” “(Panel III: From 1 st April 2012 to 31 st March 2016)”	129
4.24	“Outcomes for RSI Technical Trading Rules” “(Panel IV: From 1 st April 2016 to 31 st March 2020)”	131
4.25	Part III: - In this part the efficiency of all techniques in the study is analyzed Risk-Return Analysis of Long-Short Strategy (5-20) “(Panel-I: Whole Sample Period i.e., 01 April 2008 to 31 March 2020)”	132
4.26	Risk-Return Analysis of Long-Short Strategy (5-20) “(Panel-II: Sub Sample Period i.e., 01 April 2008 to 31 March 2012)”	133
4.27	Risk-Return Analysis of Long-Short Strategy (5-20) “(Panel-III: Sub Sample Period i.e., 01 April 2012 to 31 March 2016)”	135
4.28	Risk-Return Analysis of Long-Short Strategy (5-20) “(Panel-IV: Sub Sample Period i.e., 01 April 2016 to 31 March 2020)”	136
4.29	Risk-Return Analysis of Long-Short Strategy (5-50) “(Panel-I: Whole Sample Period i.e., 01 April 2008 to 31 March 2020)”	138
4.30	Risk-Return Analysis of Long-Short Strategy (5-50) “(Panel-II: Sub Sample Period i.e., 01 April 2008 to 31 March 2012)”	139
4.31	Risk-Return Analysis of Long-Short Strategy (5-50) “(Panel-III: Sub Sample Period i.e., 01 April 2012 to 31 March 2016)”	140
4.32	Risk-Return Analysis of Long-Short Strategy (5-50) “(Panel-IV: Sub Sample Period i.e., 01 April 2016 to 31 March 2020)”	142
4.33	Risk-Return Analysis of Long-Short Strategy (5-100) “(Panel-I: Whole Sample Period i.e., 01 April 2008 to 31 March 2020)”	143
4.34	Risk-Return Analysis of Long-Short Strategy (5-100) “(Panel-II: Sub Sample Period i.e., 01 April 2008 to 31 March 2012)”	145
4.35	Risk-Return Analysis of Long-Short Strategy (5-100) “(Panel-III: Sub Sample Period i.e., 01 April 2012 to 31 March 2016)”	146
4.36	Risk-Return Analysis of Long-Short Strategy (5-100) “(Panel-IV: Sub Sample Period i.e., 01 April 2016 to 31 March 2020)”	148
4.37	Risk-Return Analysis of Long-Short Strategy (5-200) “(Panel-I: Whole Sample Period i.e., 01 April 2008 to 31 March 2020)”	149
4.38	Risk-Return Analysis of Long-Short Strategy (5-200)	151

	“(Panel-II: Sub Sample Period 01 April 2008 to 31 March 2012)”	
4.39	Risk-Return Analysis of Long-Short Strategy (5-200) “(Panel-II: Sub Sample Period 01 April 2012 to 31 March 2016)”	152
4.40	Risk-Return Analysis of Long-Short Strategy (5-200) “(Panel-III: Sub Sample Period 01 April 2016 to 31 March 2020)”	154
4.41	Risk-Return Analysis of Long-Short Strategy (RSI) “(Panel-I: Whole Sample Period i.e., 01 April 2008 to 31 March 2020)”	155
4.42	Risk-Return Analysis of Long-Short Strategy (RSI) “(Panel-II: 01 April 2008 to 31 March 2012)”	156
4.43	Risk-Return Analysis of Long-Short Strategy (RSI) “(Panel-III: 01 April 2012 to 31 March 2016)”	158
4.44	Risk-Return Analysis of Long-Short Strategy (RSI) “(Panel-IV: 01 April 2016 to 31 March 2020)”	159
4.45	Part IV: - In this part ALPHA returns generated by techniques are analyzed. Alpha returns of markets on the basis of different techniques of Technical Analysis “(For Whole Period i.e., from 1 st April 2008 to 31 st March 2020)”	161
4.46	Alpha returns of markets on the basis of different techniques of Technical Analysis “(For Sub Period i.e., from 1 st April 2008 to 31 st March 2012)”	162
4.47	Alpha returns of markets on the basis of different techniques of Technical Analysis “(For Sub Period i.e., from 1 st April 2012 to 31 st March 2016)”	164
4.48	Alpha returns of markets on the basis of different techniques of Technical Analysis “(For Sub Period i.e., from 1 st April 2016 to 31 st March 2020)”	165
4.49	Alpha returns of EMA 5-20 on the different blocks	167
4.50	Alpha returns of EMA 5-50 on the different blocks	168
4.51	Alpha returns of EMA 5-100 on the different blocks	169
4.52	Alpha returns of EMA 5-200 on the different blocks	170
4.53	Alpha returns of RSI on the different blocks	171
5.1	Countries with their respective indexes	172

LIST OF FIGURES

Figure No.	Title	Page No.
1.1	EMA Chart for S&P 500	43
1.2	Elliot Wave Diagram	49
1.3	Head and shoulders top is shown on the left. Head and shoulders bottom, or inverse head and shoulders, is on the right.	57
1.4	Cup and Handel chart	57
1.5	A double top pattern is shown on the left, while a double bottom pattern is shown on the right	58
1.6	Triangle Chart	59
1.7	Flag and pennant chart	60
1.8	Wedge Chart Pattern	60
1.9	Top and Bottom Chart	61
1.10	Rounding Bottom Chart	62

CHAPTER 1

INTRODUCTION

1.1 Origins

Any investor can forecast future price changes in a financial market using technical analysis, fundamental research, or both. Technical analysis uses charts and a variety of indicators to track every little change in price. Using various financial statements as well as other materials like news and reports, fundamental analysis analyses relatively frequent economic scenarios. A fundamental examination of a company looks at its management, competitive advantages, and financial data including the “balance sheet and profit and loss statements.” When used in the context of futures and foreign exchange markets, it primarily concentrates on information about output and profitability as well as interest rates both nationally and internationally. One can use one of the two primary methodologies, bottom-up analysis or top down analysis, to fundamentally examine a stock, futures contract, or currency trade. The phrase is employed to set such examination apart from additional varieties of investigation, including technical examination and behaviour examination. To ascertain a market's inherent value, a fundamental method looks at all the pertinent variables influencing its price. Every time historical and current data are analysed, financial projections are the end goal (Data about production and revenue, both locally and nationally). Other possible goals include evaluating the value of the company's shares, forecasting its likely price development, projecting its financial performance, assessing the management team, making internal business decisions, and determining the credit risk involved. Economic investigation, industry investigation, and company investigation are all parts of fundamental enquiry. The shares' intrinsic value is established based on these three evaluations. This is regarded as the share's actual worth. It is recommended to purchase the share if its intrinsic value exceeds its market price, hold onto it if it is equal to the price, and sell it if it is below the price.

The premise that historical prices might be utilized to inform future investment decisions was first articulated by “Charles Henry Dow (1852–1902), pioneer of the Dow Jones & Company and Wall Street Journal.” His early research spawned several

theories and methods that are today used internationally by stakeholders to guide their trading choices. However, economists have traditionally viewed these hypotheses with suspicion and contempt. Malkiel wrote the following in his book *A Random Walk Down Wall Street* (1982):

“Obviously I am biased against the chartist. This is not only a personal predilection, but a professional one as well. Technical Analysis is anathema to the academic world. We love to pick on it. Our bullying tactics are prompted by two considerations: the method is patently false; and it’s easy to pick on. And while it may seem a bit unfair to pick on such a sorry target, just remember it is your money we are trying to save.”

“Economists are constantly interested in technical analysis because its use casts doubt on the Efficient Market Hypothesis (EMH), which holds that market prices immediately and reflect the required information completely.” According to the EMH, traders shouldn't use publicly accessible information, such as past prices, to generate extraordinarily large returns. Contrarily, technical analysis consistently contends that the currency rate is often set aside from its fair value by traders' unreasonable assumptions and actions rather than by economic fundamentals like interest rates and GDP.

After accurately recognizing price and volume trends, using technical analysis, one may predict future price fluctuations. Technical analysis typically creates graphs of previous price movements before looking for patterns to help predict the future to a large extent. This technique is based on the proposition that prices display certain geometric symmetries that, once identified, may be able to predict what is probable to occur afterwards. This in turn enables the investor to employ a successful investment approach.

Technical Trading Rules focuses on financial market-related activities. The technical analyst analyses price variations which arise daily, weekly, or over any specified time frame and can be displayed in an appropriate graphic manner, also referred to as charts. Chart analysis is the term for such a study. Technicians moreover investigate technical signs subsequent to price movements, while a chartist only analyses price charts. Technicians focus less on the fundamental variables that affect market prices and more on the price fluctuations and price movements on the financial markets.

Technical analysts always maintain that even if all pertinent statistics about a specific market or stock were accessible, you still wouldn't be able to correctly forecast how the market would react. Because there are so many factors operating simultaneously, it is easy for significant aspects to be missed in favour of the circumstances that are planned to do at that particular moment. Technical analysts believe that all relevant market information is represented (or inexpensively) in the price, with the exception of shocking occurrences like natural disasters or acts of God, But it is quite easy to ignore some relevant factors.

When the financial markets are analyzed, it demonstrates that there are patterns, trends and momentum that endure across time, albeit not in the same way. Charts for any asset class—stocks, commodities, currencies, or bonds display the same fractal structure, making them self-similar (a fractal is a small pattern; self-similar means the overall pattern is made up of smaller sorts of identical patterns). An audience's mood is reflected in a chart slightly more than the causal grounds. Thus, technical analysis of stock markets is a study of universal human attitude. As a result, another name for it is behavioural finance.

1.2 Technical analysis

- Technical analysis makes use of a variety of approaches, including as the relative strength index, regression, exponential moving average, charts, Dow Theory, wave theory and many others, to apply models and other technical trading rules based on the volume and price of transactions.
- Technical analysis frequently contrasts with fundamental analysis, which places a greater emphasis on economic variables. In technical analysis, however, we always place an emphasis on the price, volume, and other information that is readily available in the market. The majority of the time, the brokerage firms and different trading groups will work on both fundamental and technical analysis in a way that will assist them in any situation.
- Violent market makers, pit traders and day traders frequently employ technical analysis, which is extensively used by dealers and financial specialists. In the 1960s and 1970s, academics largely rejected it. According to the latest

examination by Irwin and Park, out of 95 recent studies, 56 were found that it produces optimistic results, but when proper verification was done, it was discovered that most of the positive results were reduced because of suspicious matters, such as data snooping and many other manipulations; therefore, the indication in backing of technical investigation was not conclusive; it is still viewed by many academics as a lollipop that may be attractive but not always beneficial. Many scholars believe that there is little support for technical analysis and that it denies the weak form of the EMH. Users even assert that, while technical analysis can help to discover trading opportunities, it cannot foresee the future.

- Compared to other types of analysis, such as fundamental analysis, technical analysis may be used more frequently in various foreign currency markets. Because of this, we cannot state that technical analysis is used extensively in regard to overseas markets, but we can say that it is present to some extent. Some technical analysts believe that in the majority of situations, it is discovered that the timing of the market's entry and exit is also highly essential when it comes to technical analysis. According to some researchers, it's crucial to include anomalies while using technical analysis. If the right timing is determined, it may be argued that technical analysis can profit significantly from market movements. It might not matter if you invest your money in the stock market or on international exchanges.

1.3 Conjectures used in technical analysis

The technical analysis is predicated on a number of rulebooks, which include the following:-

- i. When performing technical analysis, individual stocks may also serve as a barometer. With the modifications in the pricing, even a small or single event may be successful and can be discounted far in advance.
- ii. The relationship between price and demand determines a stock's price. It implies that supply and demand factors play a role in setting pricing.

- iii. Rational and irrational variables both have a significant impact on the supply of shares. It implies that variables both logical and irrational determine the supply of shares.
- iv. Changes in supply and demand patterns are the primary drivers of trends.
- v. The primary responsibility of the technician is to identify an unbalanced condition in such a way that it can be remedied by examining the opposing circumstance of the balancing work.
- vi. Sentiment, psychology, and the sentiments of operators or traders are the main variables affecting the market's downward or upward trend of stock prices.
- vii. Most of the times, chart patterns have a tendency to repeat themselves.
- viii. Current trends are the results of earlier trends.

1.4 Efficient market hypothesis (EMH)

Conferring to EMH, financial markets are informationally efficient. As a result, it is challenging to continuously provide returns that are better than the average market returns given the knowledge available at the time the investment is made. In addition to the usual utility-maximizing representatives, the EMH involves that agents have assumptions, that the community as an entire is precise (even if no single person is), and that when new pertinent data is revealed, the agencies apprise their predictive outcomes. It should be highlighted that the actors do not necessarily need to be rational. “EMH is aware that certain investors may overreact while others may underreact in response to fresh information. The EMH only needs that those investors' responses be arbitrary and follow a normal distribution arrangement to avoid the net effect on market prices from being regularly exploited to make an unusual profit, especially when taking transaction costs into consideration (including commissions and spreads). As a result, even if individual market participants may be erroneous, the market as a whole is always accurate. The three possible formulations of the efficient-market hypothesis are strong-form efficiency, semi-strong-form efficiency and weak-form efficiency, each of which has a distinct impact on how markets operate.

Looking at previous prices does not allow for weak-form efficient forecasting of future prices. Over the long run, using investment strategies based on previous share prices or other historical data fails to provide excessive returns. “Technical analysis methods won't be able to regularly produce additional returns, although some forms of fundamental analysis still capable of generating better returns.” Because share prices don't display sequential dependencies, there are no patterns to asset values. This infers that the price fluctuations in near future are exclusively determined by statistics not included in the price pattern. Therefore, price fluctuation must be random. Instead of requiring that prices stay at or close to equilibrium, this soft EMH just needs that market traders may not be able to generate profit consistently from market. Though, despite EMH's assertion that all price changes are random in the lack of a modification in fundamental statistics (i.e., non-trending). Numerous researches have verified that there is a pronounced tendency for the stock markets to trend over time periods of weeks or lengthier and that the degree of trending is positively correlated with the length of time period analysed (but mark that over long time intervals, the trend is sinusoidal in appearance). There have been numerous planned clarifications for such important and apparently non-random price variations.

The challenge of creating pricing algorithmically that incorporate all information in one that has received a countless transaction of consideration in the arena of computer science. For instance, it has been demonstrated that it is NP-hard to locate arbitrage prospects in pair speculating markets.

Semi-strong-form efficiency suggests that share prices react to recently released statistics very rapidly and fairly, preventing any further gains from being earned by trading on that information. According to semi-strong-form efficiency, neither fundamental nor technical analytical techniques may reliably produce excess returns. To test for semi-strong-form efficiency, the modifications to formerly unknown news should be rather large and made right away. To verify this, it is necessary to keep track of any alterations that have been made repeatedly since the first revision. If there are any such changes, it would suggest that investors acted inefficiently as a result of their distorted understanding of the information.

Since share prices represent all information, both public and private, strong-form efficiency implies that no one can provide more profits. If there are legal limitations on the disclosure of private information, such as rules against insider trading, strong-form efficiency cannot be achieved unless those limitations are routinely ignored. To test for strong-form efficiency, a market where traders are unable to constantly produce excess returns over an extended period of time must exist. Given the hundreds of thousands of fund managers worldwide, strong-form efficiency is not invalidated even if some traders are frequently experiential to exceed the market since it is fair to expect that only a few dozen star achievers will appear from even a regular distribution of returns.

1.5 Criticism and behavioral finance

Traders and academics have contested the efficient-market hypothesis philosophically and practically. The defects in financial markets, according to behavioural economists, are caused by a number of mental biases, such as overreaction, overconfidence, information bias, representative bias, and various other foreseeable human weaknesses in thinking and information dealing. These subjects have been investigated by psychologists including, Amos Tversky, Paul Slovic, Daniel Kahneman and Richard Thaler. These misconceptions in thinking cause the mainstream of stakeholders to avoid worth stocks and obtaining growing stocks at high costs, allowing those who use sound reasoning to benefit from overreactions in the sale of growth companies and bargains in neglected value stocks.

Although empirical evidence has been inconsistent, it has typically refuted the efficient-market hypothesis in its strongest version. In a 1995 research, Dreman and Berry claimed that low P/E companies offer better revenues. In a preceding learning, additionally, Dreman dubious Ray Ball's assertion that higher beta may account for the better returns. Efficient market philosophers had previously accepted Ball's study as providing an explanation for the anomaly that was entirely compatible with modern portfolio theory.

Stocks with poor returns over a number of prior years are referred to as losers. The equities that produced high returns over a comparable time frame would be considered winners. One such study's key finding is that during the subsequent retro

of the similar quantity of years, losers have significantly larger average returns than winners. Beta (β) cannot explain this discrepancy in average returns, according to a later study. Another inconsistency with EMH is the tendency for revenues to contrary over huge period prospects (i.e., scums convert into victors). In order to explain the difference in return, scums would need to take substantially greater betas than victors. The training demonstrated that the necessary beta variance to preserve the EMH is simply absent.

The arcade frequently seems to be determined by purchasers acting on growing market emotion/illogical excitement, who pay slight attention to original worth, making speculative economic lathers an obvious aberration. Smart investors can purchase stocks at steep discounts as a result of the over reactionary frenetic selling that generally follows these bubbles. Since markets can remain irrational for a longer period of time than you can remain solvent, rational investors have difficulties making money by shorting irrational bubbles. This is according to John Maynard Keynes. When it is studied as the viewpoint of efficient markets, sudden market crashes like Black Monday in 1987 seem puzzling, yet they are recognized as an uncommon statistical incident under the Weak-form of EMH.

Individual might also contend that because the hypothesis lacks predictive behaviour, it can't be comprised in numerical simulations if it is that weak. Certain of the additional auspicious replacements to EMH for stock market trading include behavioural psychology techniques (and specific venture plans pursue to adventure precisely such inadequacies). However, co-founder of the programme and Nobel Prize winner Daniel Kahneman expressed his doubt about investors outperforming the market: Simply put, they (investors) won't do it (beat the market). Simply put, that won't occur. Indeed, proponents of EMH contend that behavioural finance supports the situation for EMH since it draws attention to committee and individual biases rather than competitive market forces.

People use hyperbolic discounting, for instance, according to a notable behavioural finance result. Mortgages, bonds, annuities, and other related financial instruments not subject to reasonable arcade navies do not, which is indubitably true. Arbitrage would be prompted by any indication of parabolic pass over in the valuing

of these compulsions, instantly erasing any trace of personal bias. Similar to how derivative instruments, diversification, and other hedging techniques mitigate, if not completely eradicate, probable mispricing brought on by people's extreme risk aversion (loss aversion), as behavioural finance emphasizes, However, because they come from the human population and handle mutual funds, behavioural psychologists, economists, and other professionals are also susceptible to the biases that behaviorists demonstrate.

In contrast, the behavioural finance programme has found that market pricing signals are much less susceptible to human biases. In response to his studies on cognitive biases, Richard Thaler established a fund. He recognized complexity and rigid behaviour as key factors in the 2008 global financial crisis in a paper.

The influence of transaction costs on the idea of market competence has been further explored empirically, and a growing body of evidence suggests that any irregularities relating to market inefficiencies are the result of cost-benefit calculations made by those eager to bear the expense of obtaining the appreciated evidence in direction to trade on it. Furthermore, catching inefficiencies in tests for irregular returns requires the idea of liquidity. Any attempt to test this claim is met with the joint hypothesis problem, it makes it difficult to ever assess the market's efficiency as doing so calls for the usage of a benchmark against which aberrant returns are to be measured. One cannot assess the market's efficiency without understanding if a model adequately determines the needed rate of return. It follows that either the asset pricing model is flawed or the market is ineffective, but it is impossible to tell which the case is. The late 1980s saw the completion of a significant piece on random walks by Andrew Lo and Craig MacKinlay, who convincingly contend that arbitrary walks do not and have never existed. It took over two years for academics to accept their article, and in 1999 they circulated *A Non-random Walk Down Wall St.*, a compilation of all their previous research papers on the subject.

The full acceptance of the theory, according to economists Matthew Bishop and Michael Green, contradicts the ideas of Adam Smith and John Maynard Keynes, who both believed that irrational behaviour had a genuine effect on the markets.

Warren Buffett has also contended against EMH, most prominently in his 1984 demonstration *The Super Stakeholders of Graham-and-Doddsville*, where he claimed that the majority of the world's top money managers are value investors, refuting the claim made by EMH developers that luck is the reason some investors appear to be more successful than others. According to Malkiel, the S&P 500 Index outperformed professional portfolio managers by more than two-thirds from 1986 to 1996.

1.6 EMH and technical analysis

The efficient-market hypothesis (EMH), which provide assertions that past prices cannot be utilized to precisely predict future prices, suggests against the fundamental principles of technical analysis. Subsequently, it retains that technical analysis is unproductive. In short, the suggestion in favour of the efficient markets model is substantial, and (perhaps unique in economics) conflicting signal is scarce, wrote economist Eugene Fama in his foundational work on the EMH, which was published in the *Journal of Finance* in 1970.

Because most of the investors base their forecasts on historical results or track record, technicians claim that EMH misses how markets function. Technicians assert that it simply makes sense that previous prices affect future prices since investor expectations can have a significant impact on future stock prices. Additionally, they make reference to behavioural finance research, which shows that individuals are not as logical as what EMH portrays them to be. For a long time, technicians have maintained that stock prices are affected by illogical human behaviour, and that this conduct produces predictable results. According to author David Aronson, technical analysis practice and behavioural finance theory are complementary:

Behavioural finance considers the impact of emotions, cognitive mistakes, irrational desires, and the dynamics of group behaviour to give obvious explanations for both excessive market volatility and the additional returns produced by previously available information approaches. Intellectual mistakes may also be used to explain

market inefficiencies that result in the predictable price swings that make independent technical analysis approaches useful.

“EMH proponents respond that although individual market players may not always make rational judgements or have comprehensive evidence, their collective choices stabilize one another and provide a logical outcome (visionaries who purchase stock and bid the price upper are opposed by pessimists who sell their stock, which retains the price in equilibrium).” Similarly, since each market member brings their own unique, partial knowledge to the market, entire information is replicated in the price.

The EMH and random walk theories, according to technicians, both overlook the realisms of arcades, including the fact that market players are not entirely sensible and that recent price movements are not autonomous of earlier ones. Because the numerical aspects of such procedures and actual stock data differ greatly with regard to gap size and similarity degree, several signal processing specialists argue that stock market prices do not match Wiener processes as claimed by the random walk hypothesis. They contend that feature transformations, which are used to describe audio and biological signals, can also be successfully applied to forecast stock market prices, defying the random walk theory.

1.7 Basis of technical analysis

The Dow Theory, which was developed around the turn of the century, provides the groundwork for current technical analysis. The Dow Theory was not presented as a single cohesive whole but rather as a collection of Charles Dow's publications across a number of years. Three of Dow's many theorems stand out among the rest:

1.7.1 Everything is discounted in price

Market prices represent all available information regarding a stock's prospects for the future. Everything that can affect pricing can be discounted very effectively through the market process. Even unforeseeable occurrences like increased competition, monetary or legal issues, a takeover of the business, the demise of a founder, etc. are swiftly included into the stock price. Even unknowable (though

unpublicized) basic causes, such a sudden decline in earnings, are rarely unknowable or unexpected by everyone; individuals in the know frequently take action, and selling volume increases during rallies. Outside of a company or an industry, there are traders, investors, and analysts that can foresee developments through astute observation and astute analysis. Technical analysis makes use of the data provided by the price to determine what the market is trying to tell us about the future.

1.7.2 Price changes are not entirely arbitrary.

An upward or downward price trend will also signify facts about an organization's stock and its potential to generate future earnings, which are represented in the stock price. Price trends arise and reoccur in mostly predictable ways. History repeats itself, according to the theory of recurring tendencies. When the stock reaches this level once more, it's possible that sales will cause a price drop just as they did when there was previously a bun of stock available for sale (supply) at \$50. If it doesn't, that also reveals something because this time, demand was sufficiently high to outweigh selling. A technician thinks it's feasible to spot a trend, trade or invest based on it, and profit as the trend develops. Technical analysis can be used to identify both short-term and long-term trends throughout a variety of time frames.

1.7.3 Why is less significant than "WHAT"?

Technical analysts, or technicians, are only focused on two things:

- “What is the price right now?”
- “What is the price movement's history?”

The struggle between demand and supply for the company's stocks is reflected in the price. Forecasting the future price direction is the analysis's main goal. Technical analysis is a straightforward method because it just considers price. Fundamentalists are worried about the price's origin. For technologists, the why part of the equation is too general, and the primary justifications frequently presented are exceedingly dubious. Technicians think it is preferable to ignore “why” and focus only on “what.” The law of supply and demand provides a straightforward response to the question “why did the price go up?”

1.8 Price Fields

The majority of “technical analysis” is focused on the evaluation of “price and volume.” Below is a description of the fields that determine a stock's price and volume.

- **Open:** The cost of the first deal of the period (e.g., the first trade of the day). “The Open is particularly significant for examining daily data because it represents the consensus price after all interested parties had a chance to sleep on it.”
- **High -** This represents the stock's highest price throughout the time period. “When there were more vendors than purchasers at that time (i.e., there are always sellers willing to sell at higher prices, but the High represents the highest price buyers were willing to pay).”
- **Low -** This is the stock's lowest price throughout the time period. “When there were new sellers than buyers at that time (i.e., there are always buyers willing to buy at lower prices, but the Low represents the lowest price sellers were willing to accept).”
- **Close -** This represented the stock's final price throughout the time period. “The Close is the most frequently used price for analysis because it is readily available.” Most technicians think it's important to pay attention to the connection between the Open (the initial price) and the Close (the last price). “Candlestick charts emphasize this relationship.”
- “Volume is the total number of shares (or contracts) exchanged during the course of the reporting period. The correlation between pricing and volume for instance, the fact that rising prices are often accompanied by rising volumes is crucial.”
- “Open Interest is the total number of contracts for a future or option that have not yet been closed, exercised, or have expired. Open interest is frequently used as a gauge.”
- “A market maker's bid is the price at which they are prepared to purchase a stock (i.e., the price you will receive if you sell).”

- “This is the asking price that a market maker will accept (i.e., the price you will pay to buy the security).”

Countless technological instruments that examine pricing correlations, trends, patterns, etc. are made using these basic fields.

1.9 Fundamental data comes before technical analysis

Fundamentalists hold that fundamental issues and price fluctuations are related in a cause-and-effect manner. In other words, if the fundamental news is good, the price should go up; conversely, if the news is bad, the price should go down. However, long-term examinations of price fluctuations in global financial markets reveal that such a correlation is only marginally and only to a limited degree evident in the short-term horizon. On a medium- and long-term basis, it does not exist. In actuality, the opposite is true. The best indicator of the upcoming fundamental trend is the stock market itself. Most frequently, when the economy is still in a state of recession and there is no reason for such an uptrend, prices begin to rise in a fresh bull trend. In the reverse, when the economy is still expanding and there are no compelling fundamentals to sell, prices begin to decline in a new bear trend. The fundamental trend follows the stock market trend with a lag of many months. This also holds true for the price movements of individual stocks and corporate earnings, in addition to the stock market and the economy. Stock prices reach their peak before peak earnings and their bottom before peak losses. Technical analysis's goal is to spot trend modifications that come before the fundamental trend and don't (yet) make sense when compared to the trend's companion.

1.10 Technical analysis methods, instruments, or indicators

The below mentioned “tools and techniques” are typically used in “technical analysis.” These techniques give a trend analysis and data analysis. The following are the key technical analysis indicators:

1.10.1 “Dow theory”

1.10.2 “Charts”

1.10.3 “Support and Resistance level”

- 1.10.4 “Moving Average”
- 1.10.5 “Odd lot trading”
- 1.10.6 “Short selling Theory”
- 1.10.7 “Volume of trade”
- 1.10.8 “Fibonacci Number”
- 1.10.9 “Stochastic”
- 1.10.10 “Ralph Nelson Elliott Wave Theory”
- 1.10.11 “Oscillators”
- 1.10.12 “Filter rules”

1.10.1 Dow theory

To describe the drive of the “Dow Jones Averages” indexes in 1984, Dow devised this idea. He built his theory around a few hypotheses, which are as follows:

- a) A single purchase cannot change the way the market prices behave. However, by buying or selling a sizable quantity of a certain investment, one investor might have an impact on the daily price movement.
- b) Everything is discounted in the market.
- c) “Dow Theory clarifies that it is a method for understanding the market, not a tool for outperforming it.”

1.10.1.1 Dow Theory explanation

According to Dow, the market prices move in trends similar to how water moves. He proposes three categories of price movement, including:

- 1.10.1.1.1 Major or primary Trends (like the tide in ocean)
- 1.10.1.1.2 Trends that are secondary or intermediary (resemble Waves)
- 1.10.1.1.3 Movement that is quick (like the ripples)

1.10.1.1.1 Primary Trend: - Price trends can either be rising or falling. Bull markets are those in which there is an upward trend in the market. The

three distinct peaks are visible in the bull market. Each peak exceeds the one before it, and the price increase is accompanied by a strong trade volume.

1.10.1.1.2 Secondary Trend: - A correction arises when a secondary trend veers away from the primary trend. The secondary trend in a bull market is the outcome of an earlier advance dropping between 33% and 66%. An early rise is carried by a secondary trend. Price is raised by a secondary trend that counteracts the primary trend.

1.10.1.1.3 Minor trends: - Minor trends resemble the tiny market alterations (like ripples). They are merely the everyday changes in pricing. Secondary price movement is attempted to be corrected by minor trend. Focusing on primary or secondary trends is preferable for investors over minor trends.

1.10.2 Charts

By plotting the price history over a predetermined time period, charting allows analysts to forecast future data patterns based on observed ones. Compared to its mechanical equivalent, this method is far more subjective. The analyst must exercise discretion and talent in identifying and analyzing “patterns”. “In essence, charting is the technique of finding patterns visually within a set of data. It is first important to locate local maxima (peaks) and local minima (troughs) in the data in order to determine trends.”

A technician will trade as appropriate once they have drawn a trend line, buying foreign currency during uptrends (known as going long) and selling it during downtrends (known as selling short). It's equally crucial to spot a “trend's reversal” as it is to recognize the trend itself. A trader can make money by turning around his or her position if a trend reversal is predicted. This also makes use of peaks and valleys. Local crests are referred to as “resistance levels, and local valleys as support levels.” In a downtrend, a price that fails to breach a support level is regarded as a precursor of the trend's potential reversal.

Additionally, technicians have discovered a number of trends that they believe will help them predict future changes in exchange rates. Rounded tops and bottoms, head and shoulders, pennants, wedges and flags are a few examples of these designs. One of the most, if not the most, trustworthy chart patterns, according to practitioners, is the head and shoulders pattern. “The pattern, as per technical experts, occurs when the second peak in a sequence of three peaks is higher than the first and third peaks.” [Chang and Osler, 1995]. The neckline is defined as the line that runs between the shoulders' troughs. When the exchange rate crosses through the neckline of a “head and shoulders pattern”, the technician verifies a reversal of the earlier uptrend and begins to sell the foreign currency.

“These patterns are extremely nonlinear and complex, according to Osler and Chang (1995), and trading methods based on these outlines cannot generally be represented algebraically.” As a result, there hasn't been much research into these techniques. However, articles on the subject are starting to appear as a result of the advancement of more sophisticated nonparametric statistical approaches and increased computational capacity.

“All 32 conceivable 5-point chart patterns, including the head and shoulders outlined above, were investigated for their ability to predict the future in Levy's pioneering work on the subject from 1971, but no evidence of successful forecasting was discovered.” Then, using the Dow Jones index, *Brock et al. (1992)* discovered that breakouts from known trading ranges are significant predictors of short-term gains.

The German mark and the yen proved to have some predictive power for the head and shoulders pattern, according to Osler and Chang (1995), but not for the other four currencies. They also point out that the profits that would have been generated if one had financed in all currencies would have been “economically and statistically significant.” Using kernel regressions to smooth the data, Lo et al. (2000) investigated a number of patterns and discovered that a number of the indicators offered incremental information.

Therefore, it is clear that some research on the financial viability of charting approaches has been favourable to them. However, there aren't many studies done in

the area. The development of algorithms that can precisely identify recognizable “visual patterns, such as the head and shoulders”, that technicians themselves would be able to identify, is still challenging.

The amount of data available for technical analysis in terms of “intraday traded prices”, starting & closing day prices, and other observations is enormous. The data is typically displayed in terms of charts, which effectively plot price information.

Compared to lists of assertions, “charts” have the advantage of compressing info into a “pattern” that is simple to comprehend. Chart patterns give an analytical framework for examining the economy's situation in terms of one share or a consolidating of the market position. “Technical analysts” can assist in identifying the dominant players in the market at any given period. Investors can use this knowledge to comprehend the market and accomplish their financial objectives. “Chart pattern analysis” may be used to make both short- and long-term forecasts. The data might be “monthly, weekly, or intraday, and the patterns could last a single day or several years.” Additional applications for the charts include:

- Recognize current purchasing and selling tendencies
- Use projection to indicate the market's likely future course of action
- Displays post-historic performance
- Marks significant regions of support and opposition

Some of the commonly used charts are:

1.10.2.1 Line charts/Line and Volume Charts

1.10.2.2 Bar Charts

1.10.2.3 Point and Figure charts

1.10.2.4 Candle stick charts

1.10.2.1 Line chart

“The line chart links prices through time and is better suited for spotting long-term patterns. The closing price is shown against time on a line.”

1.10.2.2 Bar chart

The bar graph informs the chartist of price variations over time. This plots the share price or index level's high, low, open, and close against time.

1.10.2.3 Point and figure chart

Only price changes are displayed on the point and figure chart. It removes detail-related noise, focusing exclusively on trends. The two separate signs of cross and round denote a rise or fall in a pricing range, respectively.

1.10.2.4 Candlestick chart

While plotting data similarly to bar charts, candlestick charts may give a more intuitive perspective. Wicks are displayed at both ends of a vertical rectangle that represents a candlestick. The rectangle is transparent when the closing price is higher than the opening price, and black when the opposite is true.

Price trends and historical patterns are two fundamental truths (tenets) of technical analysis. "A bullish market suggests that the forces of supply (bears) are in charge, which causes a decrease in share prices, while a bearish market implies that the forces of demand (bulls) are in charge, which results in an increase in share prices."

1.10.3 Support and Resistance Level

The "support and resistance levels" should be known by anybody with an interest in technical analysis. At a price when strong demand for a particular stock is anticipated to stop future declines in the price level, there is a support level. If there is projected demand for a particular stock, the price decline may be temporarily stopped or it may even lead to a price reversal at the support level. The quantity of stock would be higher than the demand at the resistance level, preventing further price growth. The price hike has temporarily been postponed due to increased selling pressure. Support and resistance levels typically appear when the trading of many shares is concentrated at a few price levels.

A level that the stock reaches and then declines below is referred to as a resistance level, while a level that the stock reaches and then rises over is referred to as a support level. We can visualize it mathematically by using the example below: A share's price may increase and reach Rs. 210 if it remains constant at roughly Rs. 150 for a few weeks. The stock keeps dropping till it reaches about Rs. 150, where it stops. Then, it ascends. In this scenario, the support level is set at Rs. 150. The scrip is currently inexpensive, so investors acquire it, driving the price higher due to increased demand. Given that the price is high and that Rs. 210 will act as a resistance level, there will likely be selling pressure that will cause the price to fall.

1.10.4 Moving Average Approach

An average is calculated by dividing the total share price over a number of weekly intervals by the total number of weeks. The most recent date for which a price bar has been plotted is used to mark this point. The preceding data is subjected to this technique once more. “The moving average line is created by connecting the points that were so obtained. Simple historical data display is what a moving average is.” The most crucial component of a moving average is the data it is based on. The average of the prior data is what determines each data point. A moving average of 15 days calculates the average of the past 15 trading days. “The specialist can identify long-run patterns from short-run changes by plotting a moving average.”

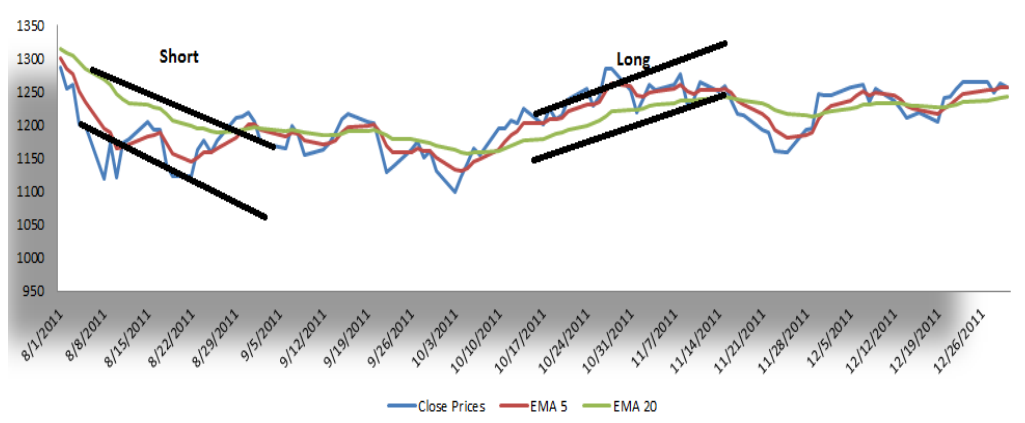


Figure 1.1 EMA Chart for S&P 500

“A moving average is the average stock price or exchange rate over a specific number of past trading days.” “Moving average trading is the practice of systematic buying and selling when a price crosses its average.” The notion holds that prices of security move in trends, and at any one time, they are either in a downtrend or an uptrend. An uptrend is a period of rising prices, whereas a downtrend is a period of declining prices. When a price passes through its average from below and a buy signal occurs, it is said to be in an uptrend since recent prices are higher than earlier prices. The price is deemed to be in a downtrend when it passes through the average from above and a sell signal is provided, much like how current prices are lower than earlier ones. A buy signal should be followed with a buy, and a sell signal by a sale. If the price level movement between buy and sell signals is sufficient to cover costs, moving average trading can be profitable. “On the other side moving average trading incurs losses if the price spread between buy and sell signals is adequate to cover expenses.” Whether a moving average indicates long- or short-term trends depends on the size of the window, commonly known as the number of days it covers. “A short moving average will be smoother than a long moving average, and any moving average will be flatter than the initial exchange rate series.”

The definition of “moving average trading” typically takes the shape of a trading rule. An investment decision is mapped onto the price using a trading rule. “When a short moving average crosses a longer moving average from above (below) or when the exchange rate is rising (dropping) very rapidly a common moving average trading rule provides a buy (sell) signal.” For instance, the green lines in Figure 1.1, which depicts the EMA for the S&P 500, represent the EMA 20, and the red lines, the EMA 5. As in the previous instance, it is clear that when the “EMA 5” is below the “EMA 20”, a sell signal is generated. As the situation develops, however, the EMA 5 begins to cut the EMA 20 from below, which generates a buy signal.

Oscillators are the last category of mechanical trading rules. These are employed to identify transient overbought or oversold conditions. They are considered to be especially helpful when there is no clear trend in the market, or when the currency rate is not significantly moving upward or downward. “For instance a

straightforward oscillator index might be the sum of two moving averages: a 5-day moving average minus a 20-day moving average.”

1.10.5 Fibonacci numbers

Around the year 1170, mathematician Leonardo Fibonacci was born in Italy. “The association between the numbers that are now known as Fibonacci numbers was found by Fibonacci while he was studying the ancient Pyramid of Gizeh in Egypt.” The Fibonacci sequence of numbers includes 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, etc., where each new number equals the sum of two preceding ones. These numbers have a fascinating assortment of connections between them, such as the fact that each number is roughly 1.618 times the one before it and roughly 0.618 times the one after it. Fans, retracements, temporal zones, and other Fibonacci study arcs are the four most widely used ones.

In order to comprehend this research, one must predict changes in patterns when prices approach the Fibonacci lines. Moving averages are used to analyse both market and individual scrip price changes. The underlying trend in the stock is indicated by the moving average. The period of the trend that is being detected is based on the average period. 10 to 30 day moving averages are used to determine short-term trends. For medium-term trends, time horizons of 50 to 125 days are used. “Long-term trends are identified using the 200-day moving average.”

1.10.6 Odd lot trading

Typically, shares are sold in lots of 100. Odd lot shares are those that are sold in smaller quantities of fewer than 100. Odd lotters are such kind of buyers and sellers. “The odd lot index is the ratio of odd lot purchases to odd lot sales (Purchase% Sales).” The index rises as the number of odd lot purchases rises. More selling than usual causes the index to decline. Professional investors are often thought to be stronger and more knowledgeable than odd lotters. The stock market is theoretically sound when expert investors are in control. If odd lotters control the market, it is thought that the market is technically unsound. The idea is that odd lot purchases are focused at the peak of the market cycle and sales are concentrated at the trough.

1.10.7 Volume of trade

Price behaviour has an impact on trading volume. Dow specifically highlighted volume. In a bull market, volume grows whereas in a down market, it shrinks. Traders should be concerned if volume decreases when prices increase or vice versa because it suggests that the trend may not last much longer. Volume was a great way for technical analysts to validate the trend. When modest and big volumes of trading follow a price decline and price increase, the market is said to be bullish. Bull markets are characterized by high volume and price increases. The same holds true for raising volume if there are five days of volume drop followed by four days of volume increase.

1.10.8 Short sales

The technical metric of short interest is short selling. Selling shares that are not held is referred to as a short sale. The short sellers known as bears sell now in the hopes of making a profit later by repurchasing at a reduced price. The short sellers must conceal their holdings. The business newspapers publish short holdings of scrips. There are more open short positions when there is a greater demand for a certain share, which suggests that prices will climb in the future. Although these signs cannot be entirely accurate, they do depict the usual scenarios.

$$\text{Short Interest Ratio} = \frac{\text{Short Interest Position}}{\text{Average Daily Trading}}$$

This interest explains how long it will take to satisfy our short-term interest. When it passes through the two, it is at a high level. The philosophy of short selling is merely an all-encompassing or typical approach; it is not a specific indicator. Technical investors or analysts believe it to be an alien technique that short-term investors are unable to comprehend.

1.10.9 Stochastic

“A continuous evolution of jointly distributed random variables characterizes the stochastic process.” A stock's price is compared to its trading range over the previous n time periods using the stochastic oscillator.

It is a technical indicator of oversold conditions. It is possible that purchasers will enter the market and drive the price up if a share or index is judged to be oversold. The price will fall if a share is “over purchased,” on the other side, as sellers will outnumber purchasers. The stochastic oscillator can continue to be overbought or oversold in trending markets. The stochastic oscillator may continue to be overbought in a strong uptrend, while it may continue to be oversold in a strong downtrend. The stochastic oscillator performs well in non-trending or consolidating markets from a timing viewpoint. A stock's closing price level is compared to its range over a given amount of time by the stochastic oscillator. In “up-trending markets, prices typically close near their peaks, while in down-trending markets, prices typically close near their troughs.”

Two lines represent the stochastic indicator on the graph:

The Percent D, % D Line

The Percent K, % K Line

“Of the oscillators, the % K is more sensitive, but the % D line has more significance and produces important signals. Both of these numbers fall between 0 and 100.” The afore-mentioned values are regarded as strong and indicate that prices are closing close to their peaks. Values below 20 are signs of weakness and signal that prices are approaching their lows.

Typically, it is predicted that “%k will shift direction before %D. However, when both the % K and % D lines reverse, and the faster % K reverses to retest a crossing of the % D line but does not cross it, a slow and steady reversal is frequently suggested. This is a confirmation of the stability of the preceding reversal.”

The stochastic or "raw stochastic" parameter K's formula is

$$K = 100 * \frac{CL - Ln}{Hn - Ln}$$

When, “CL= The present day's close”

“Ln means low point in the last n days.”

“Hn means maximum value for the last n days.”

“N is the number of days, usually at least five.”

The number of time periods (n days) utilized in the % K calculations are then used to calculate a moving average of that number. “The name of this moving average is % D. % D is a smoothing factor for % K and a one-day moving average of % K.” Sometimes, the formula for % D might be calculated as follows:

$$\%D = 100 * \frac{Hn}{Ln}$$

“L= The lowest low for the n-day period.”

“H= The highest high for the same n- day period.”

“The fast stochastic (% K) and (% D) are plotted on some chart.”

1.10.10 “Ralph Nelson Elliott Wave Theory”

“Based on Ralph Nelson's Elliott Wave Theory/Principal, technical analysis is conducted. The fact that periodic regularity has been the fact of nature of tides, whether, or of life was the foundation for this theory's development. It has the ability to recurrence itself forever.”

The Elliott wave theory is a type of technical analysis used to forecast trends in the stock market and other societal behaviors. “The idea was devised in the 1930s by accountant Ralph Nelson Elliott (1871–1948), who argued that market values unfold in particular patterns.”

“In the book The Wave Principle (1938) and a series of articles in the magazine Financial World in 1939, Elliott presented his theories on market behaviour.”

According to Ralph Nelson's wave theory, these motions are defined by two forces: one that builds up and one that tears down. Elliott observed that the market advanced in five waves before declining in a sequence of three waves. These waves are shown in the diagram below:

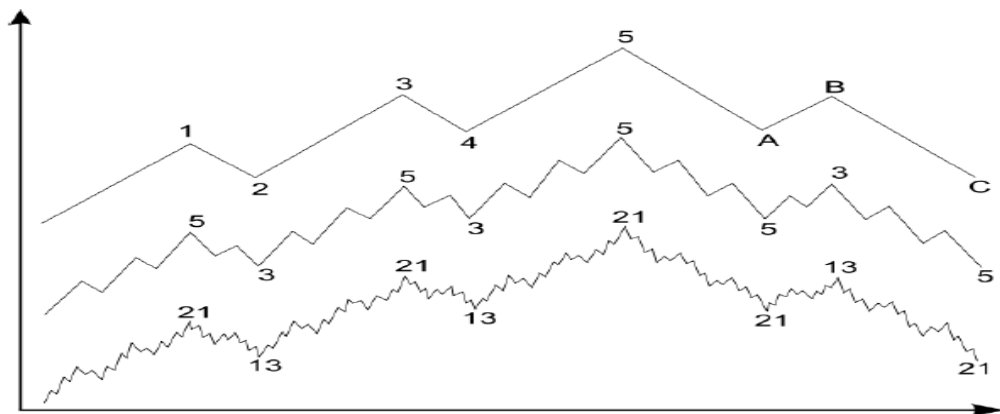


Figure 1.2 Elliot Wave Diagram

Source: R.N. Elliott's essay, "The Basis of the Wave Principle", Oct. 1940

The “Elliott Wave Principle was created by Ralph Nelson Elliott in the 1930s” after he realized that financial markets, despite appearing to behave somewhat erratically, actually did not. However, he did find that they traded in what he called repeating cycles, which turned out to be investor emotions brought on by outside forces or the prevailing psychology of the period.

“He had begun by noting that the upward and downward swings of mass psychology always manifested themselves in the same repeated patterns, which he then separated into patterns he called waves.” The Dow hypothesis serves as a foundation for the theory. Chartists thought Elliott was able to break down and examine markets in great depth because of the markets' fractal character. On a smaller scale, fractal mathematical structures repeat themselves eternally.

Trends and corrections of sideways price movements are two different types of price movements. Price movements follow the trend, while corrections buck the trend. These are referred to as (impulsive waves) and (corrective waves) in Elliott wave theory.

“According to Elliott's model, market prices fluctuate between five waves and three waves at all trend levels.” The greater pricing pattern emerges as these waves grow in size using fractal geometry that is self-similar. Waves 1, 3, and 5 of a dominant trend are motive waves, and each motive wave is further divided into five waves. Corrective waves 2 and 4 are separated into three waves. The pattern is

reversed in a bear market, where the primary tendency is negative and there are five waves down and three waves up. Corrective waves travel in opposition to the trend, but motive waves constantly follow it.

1.10.10.1 Degree

Five and three wave structures with escalating size or intensity are formed by the pattern link. 89 waves make up the entire motive pattern, which is followed by 55 waves for the entire corrective pattern.

“Each degree of the pattern in a financial market has a name. Financial managers use symbols for each wave to indicate its function and degree, using numbers for motive waves and letters for corrective waves (shown in the highest of the three idealized cycles) Degrees are relative since they are based on shape rather than size or length.”

Despite the fact that a wave's classification at any particular degree may vary, experts normally agree on the typical sequence or degree:

- Grand Super Cycle means Multi-decade to multi-century
- Sup Cycle means a few years to few decades
- Cycle means a year to few years
- Primary means a few months to a couple of years
- Intermediate means weeks to months
- Minor means weeks
- Minute means hours
- Sub-Minute means minutes

1.10.10.2 Wave Signature and behavioural traits

According to Elliott Wave analysts (also known as Elliotticians), it is not essential to view a “price chart in order to determine where a market is in its wave pattern.” Each wave has a unique "Signature" that frequently mirrors the current

psyche. Understanding the properties of wave pattern is essential to applying the wave principle since it explains how and why waves occur.

These wave characteristics presuppose an equity bull market. In a down market, the traits are reversed.

1.10.10.3 A five-wave structure (dominant trend)

Wave 1: Wave 1 is rarely immediately apparent. The fundamental news is virtually always bad when a fresh bull market's first wave starts. It is believed that the prior tendency is still very much in effect. Fundamental analysts keep lowering their earnings projections; the state of the economy is probably not good. As prices climb, volume may somewhat increase, but not by sufficient to alarm many technical specialists.

Wave 2: Wave second alters wave first, but it can never go past where wave one began. Usually, the news is still unfavorable. Bearish mood soon increases as prices retest the previous low, and "the crowd" proudly reminds everyone that the bear market is still well established. Even yet, there are some encouraging indicators for those who look: wave two's volume should be smaller than wave one's.

Wave 3: Wave 3 is typically the biggest and strongest wave in a trend (even if some data indicates that wave five is the biggest in similar markets). Now that the news is good, "fundamental analysts" are starting to improve their projections. Prices increase swiftly, and improvements are shallow and fleeting.

The news is likely still gloomy when wave three (wave three) begins, and the majority of market participants continue to be bearish; however, by wave 3's midpoint, "the crowd" will frequently join the new positive trend.

Wave 4: Wave four usually comes with a blatant corrective. Prices could fluctuate sideways for a while. If you are aware of the potential for wave-5 to come, this is an excellent place to purchase a pullback. However, the most distinctive quality of the fourth wave is that it is frequently quite challenging to count them.

Wave 5: Wave 5 is the last leg in the prevailing trend's direction. Everyone is optimistic since the news is overwhelmingly positive. Unfortunately, this is the point,

just before the top, when many casual investors finally buy in. Because wave five's volume is smaller than wave three's near the end of a major bull market (and a number of dynamic indices start to show divergences), negative sentiment may very well be ridiculed (prices reach a new peak)

1.10.10.4 “Three wave pattern (corrective trend)”

Wave A: “Corrections are frequently more difficult to spot than impulse moves.” The fundamental news is typically still favourable during wave A of a bear market. “Most analysts view the decline as a correction in a bull market that is still in motion. Increased volume, growing implied volatility in the options markets, and maybe a move higher in open interest in the future markets are some technical indicators that go along with wave A.”

Wave B: “Prices turn higher, which many interpret as the continuation of the now-defunct bull market.” The peak may be recognized by those who are familiar with traditional technical analysis as the right shoulder of a head and shoulders reversal pattern. “Wave B has a lesser volume than Wave A.”

Wave C: “Five waves of abrupt price decline. By the third leg of wave-C, as volume increases, practically everyone is aware that a bear market is well established.” Usually, wave C is at least as big as wave A.

1.10.11 Oscillators

For the purpose of displaying the tendencies of certain companies, the researcher uses "Oscillators." The oscillators show the momentum of the market or a certain security. The oscillator displays the share price movement from one extreme to another across a reference point. The momentum suggests the following:

- “Overbought and oversold situations of the security or the market.”
- “A potential trend reverse.”
- “An increase or decrease in momentum.”

Oscillation is the repeated movement of a certain object along the same path and frequency, such as a pendulum in a wall clock. Oscillators signal trend reversals, which must be validated by changes in the scrip's price. Only buy and sell signals can

be created, and price changes should be associated with changes in momentum. Only when the price and momentum are in sync, decisions must be made. Oscillators are created using the closing prices on a daily, weekly, or monthly basis. Weekly prices are beneficial for trading on a short time scale. These oscillators are excellent instruments for anticipating future movements well in advance of such movements occurring, giving decision-makers enough time to consider them before acting. The well-known oscillators track the trend analysis of the chosen companies under investigation using their monthly closing stock prices.

- “Moving Average convergence and divergence (MACD)”
- “Rate of change (ROC)”
- “Relative strength Index (RSI)”

1.10.11.1 Moving Average Convergence and Divergence (MACD)

It is employed to forecast market changes. In most cases, an analyst is unsure about whether to utilise a long- or short-term moving average. The answer to this kind of conundrum is MACD. The MACD is the ratio of the short-term to long-term moving averages. This distinction makes it easier to determine whether recent price movements have been upward or downward when contrasted to movements over longer time periods. Diverse indications can be produced using the MACD line;

“MACD can be calculated by deducting long period moving average from short period moving average.”

“The MACD can be used to create straightforward buy and sell signals. When the MACD is in the positive zone, purchasing is suggested because share values are anticipated to rise in the future.”

“On the other hand, when MACD is in the negative zone, it suggests that the market will move down (southward) in the near future and that one should sell the shares.”

1.10.11.1.1 Enhanced signals using the MACD

- “The MACD signals a bullish market for the stock whenever it is above the zero mark line.”

- The “MACD serves as an early indicator of a negative market whenever it is rising but above the zero-mark line.”
- When the “MACD is below the zero-mark line, it signals a bearish market for the underlying security.”
- “Whenever MACD develops a peak near the top, it indicates that the market is overbought and will shortly turn bearish.”
- “When the MACD reaches its bottom, it denotes an oversold condition, meaning the market will begin to become bullish.”

1.10.11.2 Rate of change (ROC)

The rate of change between the present price and the price "n" days ago is measured by the rate of change indicator, or ROC. ROC aids in identifying overbought and oversold scrip positions. It is helpful in spotting trend reversals as well. In order to determine the ROC, closing prices are employed. Additionally, the researcher collects ROC monthly closing prices.

$$\text{ROC} = \frac{\text{Current Price}}{\text{Price N Months ago}}$$

1.10.11.2.1 Advance signals with ROC assistance

When ROC reaches its maximum, the market is overbought. When the ROC is above the "one" mark and rising, the market for the scrip is in a bullish trend. When the ROC is above the "one" level and dropping, the market for the scrip is in a bearish trend. When the ROC is at the bottom, the market is oversold.

1.10.11.3 Relative Strength Index (RSI)

A well-known basic momentum oscillator was created by “Wilder in 1978 and is called the Relative Strength Index (RSI)”. The RSI oscillator is used to determine the technical strengths and weaknesses of a specific market scrip. Under RSI, price gains and losses over a specific time period are determined using prices from the most recent few days. To determine if a market is overbought or oversold, the value of RSI is calculated and is plotted on the graph. After an overbought or oversold condition, the market always goes in the opposite direction.

The “market is likely to hit its top since it is overbought when the RSI number is at or above 70 and trending upward. The market is oversold and is likely to bottom out when the RSI value is at or below 30 levels, on the other hand. Confirmation and safe indications are generated using the RSI level between 50”. After an overbought or oversold scenario, the market always moves in the other direction.

RSI can be calculated as under:

$$100 - 100 - \frac{100}{1+RS}$$

Where RS can be calculated as under:

$$\frac{\text{Average of N days advance}}{\text{Average of N days decline}}$$

The value of RSI is studied as overbought and over sold:

When the value of indicator is 70, it is identified as overbought market whereas when the value is 30, it is identified as oversold market.

1.10.11.3.1 Using the RSI to create signals

- When the RSI reaches the 50 threshold, a positive market is expected for the underlying security.
- When the RSI hits the 70 mark from below, the market is overbought.
- When the RSI falls after reaching its top, a negative market is about to start.
- When the RSI crosses the 30 level from upward, the market is oversold.

1.10.12 Filter rules

Trading range break rules, also known as filter rules, advise purchasing (selling) a currency when it increases (decreases) by a certain percentage over (below) its most recent local minimum (maximum). The technician determines the filter's dimensions as well as the window from which the local minima are picked. According to Neely (1997), filters typically ranged in price from 0.5% to 3%.

“When the oscillator index reaches an extraordinarily low (high) value according to oscillator regulations you should buy (sell) the foreign currency.” So it seems sense that moving average rule signals might be produced using an oscillator chart.

1.11 Recognizing the pattern and trend

Making predictions about stock prices or any other financial market without understanding the pattern and trend in the relevant market is truly a very difficult assignment for investors as well as analysts. A chart pattern is a distinctive pattern that may be identified on a stock chart and is used as a trading signal or portent of possible price movements. Chartists employ these patterns to identify current trends, trend reversals, and to provide buy and sell signals.

Within this branch of technical analysis, there are two different kinds of patterns: reversal and continuation. When a reversal pattern is complete, it indicates that a previous trend will have changed. In contrast hand, a continuation pattern indicates that once the pattern is finished, a trend will continue. The charts of any timeframe can contain these patterns. We will go over a few of the more well-known chart patterns in this part.

1.11.1 Head and Shoulders

“A well-known and dependable technical indicators in technical analysis is this one.” A head and shoulders chart pattern indicates that the security is likely to go against the prior trend when it appears. There are two variations of the head and shoulders chart pattern, as shown in Figure 1.3. “A chart pattern called a head and shoulders top, which forms at the peak of an upward trend, indicates that the upward trend is likely to come to an end.” The less well-known of the two, head and shoulders bottom, often referred to as inverse head and shoulders (seen on the right), is used to indicate a downtrend's reversal.

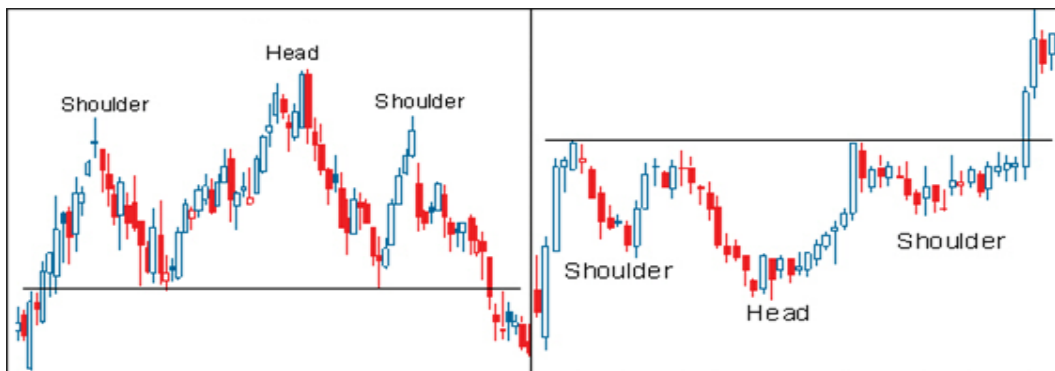


Figure 1.3: “Head and shoulders top is shown on the left. Head and shoulders bottom, or inverse head and shoulders, is on the right”.

1.11.2 Cup and Handle

“In a cup and handle chart, the upward trend has stalled but will resume once the pattern is confirmed.” This is a bullish continuation pattern.

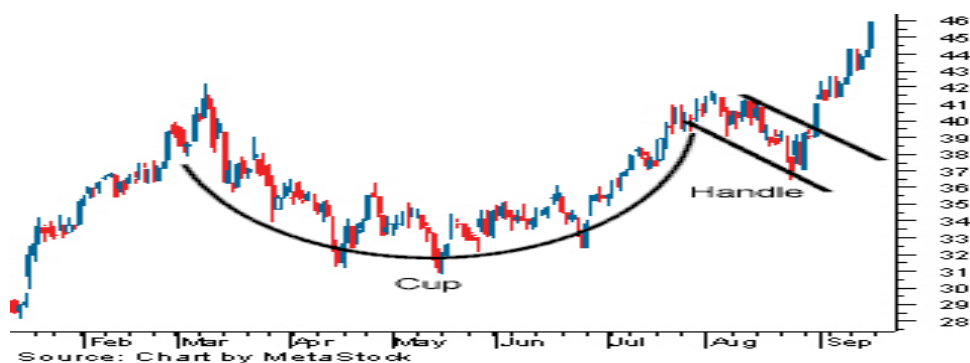


Figure 1.4 Cup and Handel chart

“Figure 1.4 illustrates how this pricing pattern resembles a cup and is preceded by an upward trend.” The price of the security moves generally downward or sideways to form the handle, which comes after the cup construction. “The upward trend can continue after the price movement breaks through the handles created resistance lines.” This kind of pattern can occur throughout a wide range of time periods, from a few months to more than a year.

1.11.3 Double Tops and Bottoms

This popular chart pattern, which is frequently utilised, also depicts a trend reversal. It is regarded as among the most trustworthy designs. These patterns appear after a sustained trend to alert chartists of the impending trend reversal. When a price

movement fails to successfully break through support or resistance levels twice, a pattern begins to take shape. Indicators of intermediate- and long-term trend reversals usually follow this pattern.

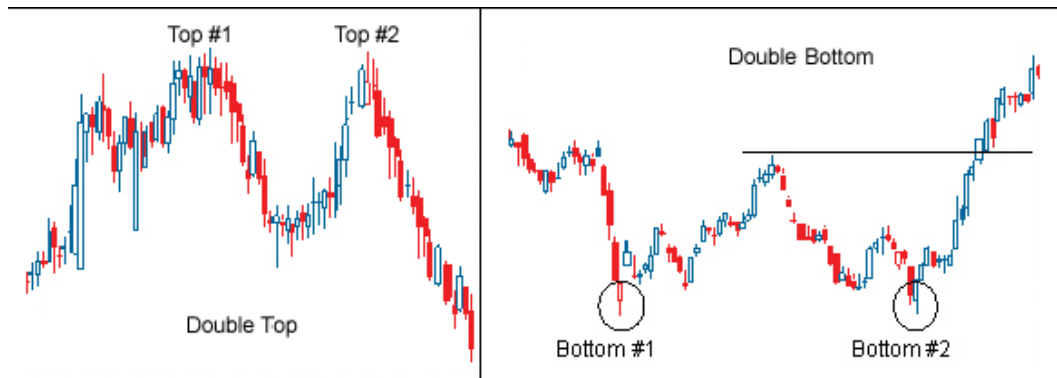


Figure 1.5: On the left, a double top design is displayed, and on the right, a double bottom pattern.

“The price drive has twofold attempted to climb above a particular price level in the instance of the double top pattern in Figure 1.5.” The trend contraries as the price moves lower after two failed attempts to raise the price. “In the instance of a double bottom (shown on the right), the price movement has twice attempted to go lower but has encountered resistance both times.” The security initiates a new trend and moves upward after the second bounce off the support.

1.11.4 Triangles

“Some of the most common chart patterns in technical analysis are triangles.” The symmetrical triangle, ascending triangle, and descending triangle are the three different sorts of triangles, which differ in their construction and implications. These chart patterns are thought to persist for a few weeks to several months.

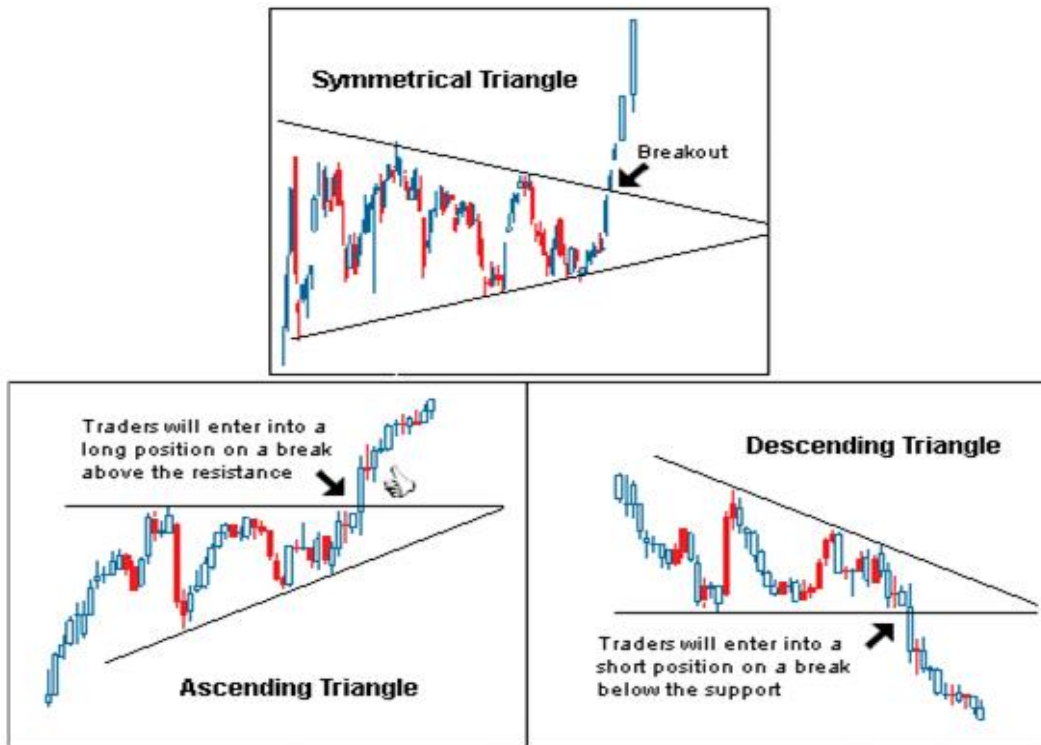


Figure 1.6 Triangle Chart

Two trend lines converge in the direction of one another to form the symmetrical triangle in Figure 1.6. This pattern is neutral because a breakthrough in either the upside or the downside confirms the direction of the trend. The bottom trend line of an ascending triangle slopes upward, whereas the upper trend line is flat. Chartists search for an upside breakout in this pattern, which is typically viewed as optimistic. The upper trend line in a descending triangle is declining, while the bottom trend line is flat. Chartists search for a downside breakout in this pattern, which is typically viewed as bearish.

1.11.5 Flag and Pennant

These two persistence patterns on short-term charts appear when a rapid price movement is accompanied by a largely sideways price movement. Once again, a sharp price movement in the exact same way as the trend-starting move completes this pattern. The patterns typically endure one to three weeks, according to general consensus.

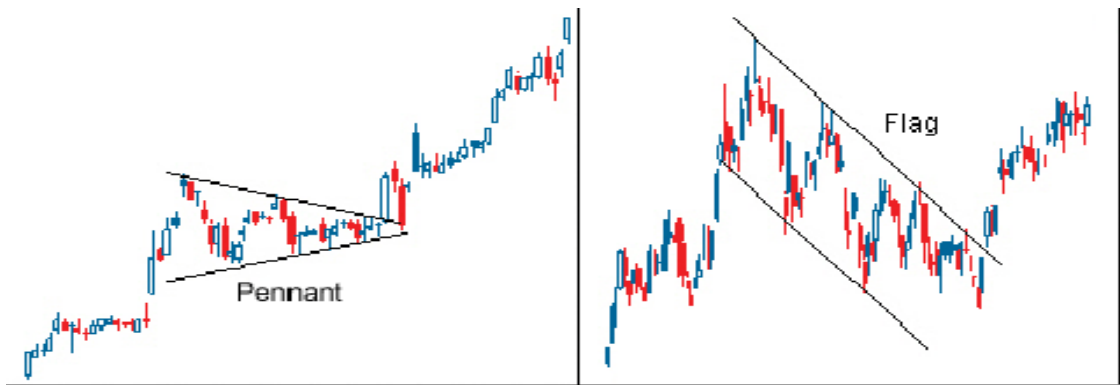


Figure 1.7 Flag and pennant chart

A pennant and a flag are similar to one other, as seen in Figure 1.7. The centre portion of the chart pattern highlights the fundamental distinction between both price moves. Converging trend lines, like those in a symmetrical triangle, define the middle portion of a pennant. On the other hand, the central portion of the flag pattern displays a channel pattern with no convergence of the trend lines. When price crosses the upper trend line in either scenario, the trend is anticipated to continue.

1.11.6 Wedge

The wedge chart pattern has two possible outcomes: continuation or reversal. “While it resembles a symmetrical triangle the wedge pattern slants upward or downward whereas the symmetrical triangle often moves horizontally.” The other distinction is that wedges often take longer to form between three and six months, on average.

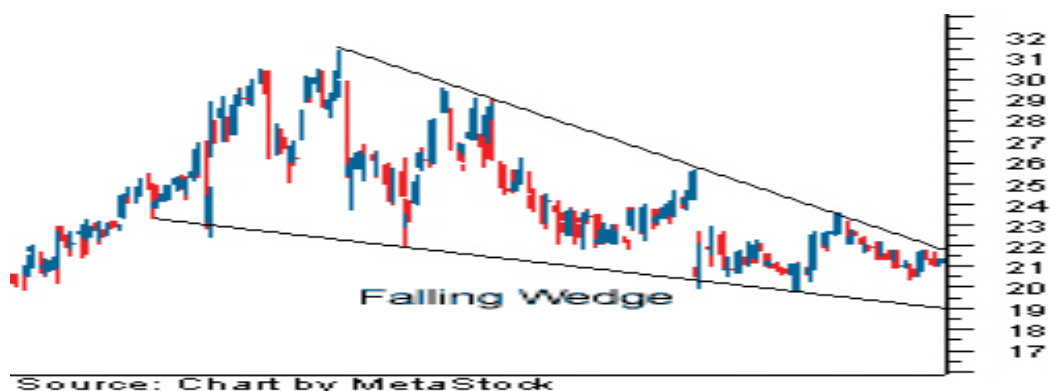


Figure 1.8 Wedge Chart Pattern

Reading signals can be challenging because to wedges' dual classification as continuation and reversal patterns. However, “a falling wedge is bullish and a rising wedge is bearish at the most fundamental level.” Two trend lines in Figure 1.8 are forming a falling wedge that is pointing downward. A move below the lower trend line would indicate a reversal pattern, while a rise above the higher trend line would indicate a continuation pattern.

1.11.7 Gaps

The space which remains empty in between to one trading period to the next trading period is popularly called as chart. When there is a significant price differential between two consecutive trading periods, this happens. “For instance there will be a significant gap on the chart between two periods if the trading range in one session is around \$25 and \$30 and the following trading session opens at \$40.” “On bar charts and candlestick charts gap price fluctuations can be seen, but not on point-and-figure or simple line charts.” Gaps typically indicate that a significant event, such as an announcement of better-than-expected earnings, has occurred in the security.

There are three basic categories of gaps: runaway (measured), breakaway, and weariness. At the beginning of a trend, a breakaway gap appears, followed by a runaway gap in the middle, and a fatigue gap near the end.

1.11.8 Triple Tops and Bottoms

Triple tops and bottoms are another type of reversal chart pattern in chart analysis. The behaviour of these patterns is comparable to head and shoulders and double tops and bottoms, despite their less frequent occurrence on charts. These two chart patterns show up when a price movement tries three times but fails to break through a level of support or resistance, suggesting a trend reversal.

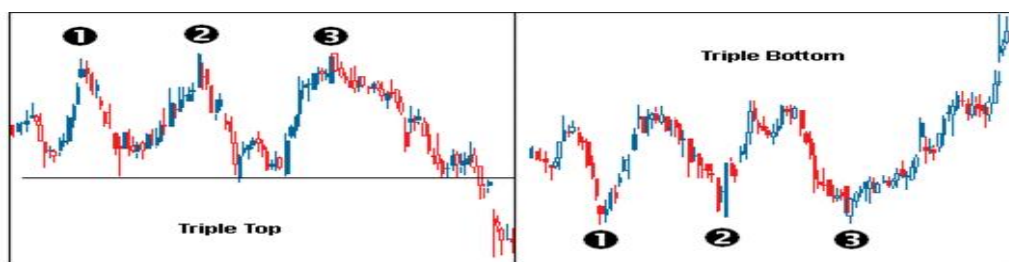


Figure 1.9 Top and Bottom Chart

Triple tops and bottoms can look similar to other chart patterns, which can lead to confusion during the pattern's construction. This pattern resembles a double top or bottom after the first two support/resistance tests are made in the price action, which might tempt analyst to take a setback position quickly”.

1.11.9 Rounding Bottom

The rounding bottom, also known as a saucer bottom, is a long-term turn around pattern that denotes a change in trend from one of decline to rise. According to conventional wisdom, this cycle can persist anywhere from a few months and several years.

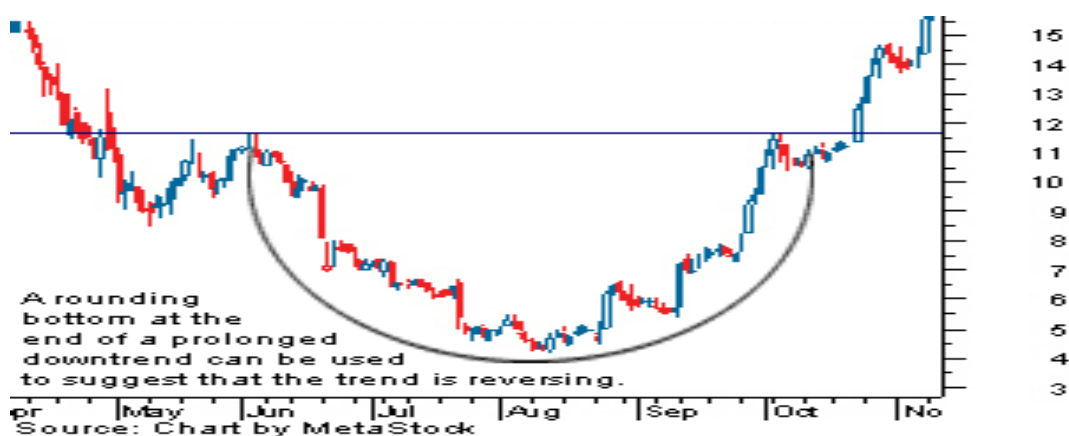


Figure 1.10 Rounding Bottom Chart

A cup and handle chart pattern resembles a rounded bottom chart pattern, except the handle is absent. It is challenging to trade this pattern due to its long-term nature and the absence of a confirm signal, like the handle in the cup and handle. Our examination of some of the more well-known chart patterns is now complete. By this point, one should be able to identify every chart pattern and the signal generated by the chart for the chartists.

After getting the familiarity with the concept of technical analysis and the various techniques which are normally used in technical analysis, the researcher has decided to make the further investigation using the techniques of technical analysis on a well-recognized group of nations which for the present study is BRICS. The researcher will try to find out the excessing returns using active strategy over passive strategy which is termed as Alpha returns in the study. Hence, the present study

“Testing Alpha Returns in Equity Indices: A Post Recession Analysis of BRICS”

is taken for the research.

What is BRICS?

Initially, in 2001, BRIC was created by Jim O’ Neill, who forecasted that these four nations would take hold on the whole world’s economy by 2050. Later in 2010, Saudi Arabia was added too to the group and it was titled as BRICS. There have been many reasons behind the forecast by Jim O’ Neill like low labour rate, an abundance of natural resources at an era of a global merchandises boom and good demographics. This leads BRICS nations towards fastest growing emerging nations among the world.

In general, these conferences are organized to support the “BRICS countries' economy and provide their leaders an opportunity to collaborate on these projects.” In December 2010, “South Africa became a member, altering the name to BRICS.” “These emerging economies account for around 31% of global GDP and 42% of global population, respectively, according to the World Factbook.”

CHAPTER- 2

REVIEW OF LITERATURE

Horne & Parker (1968) in his study on Technical Trading Rules has made an investigation in the thirty industrial stocks from the New York stock exchange and used the weighted moving average to find out the behavior of stock prices. The study is conducted on the daily data of these stock prices. The results of the study concluded that the forecasting of stocks on the basis of weighted moving average is not feasible and the trend of the prices of stock is based on random pattern and cannot be predicted in advance.

James (1968) has examined the 798 stocks and used the moving average technique to discover whether the technique can generate the better returns or not. The study results that there are not very much proofs about the better returns in case of using the moving averages. The outcomes of the study support that there are only some evidences that the EMA can generate better outcomes over the buy and hold strategy.

Fama (1969) in his study conducted the research on testing the efficiency of capital markets. The work is done on the basis of three forms of efficiency in the capital markets which are weak form, semi strong form and strong form. The work concluded in the end that most of the capital markets are found to be very efficient. Only some of the markets with some adjustments are found to be less efficient and the predictability of these markets is possible with the support of some specific methods. He also concluded that the efficient market model held better in most of the capital markets.

Treynor & Ferguson (1985) has analysed the research to find out the impact of information available to the investors and how that data can be used to achieve the unusual profits in the markets. The research depicts that the data which is available to the stock investor can be used only in those cases where the stock holders has knowledge about how this information can put an impact on the prices of the securities. The paper at last concluded that nonpublic information which is available to the investor can be used and have the chances of giving the unexpected profits to the investor to whom such information is available.

Malkiel (1989) has investigated the efficiency of market regarding the efficient market hypothesis. He analyzed that in most of the cases the EMH holds true. He found cases in which EMH was not present but the number of such cases are not enough to doubt EMH. It was found that such type of inefficiency will not be for long time and will disappear at the very earliest time. It was concluded by the researcher that we cannot neglect the fact of EMH on the available data.

Brown & Jennings (1989) in this paper the researcher has conducted the study on the technical analysis by using the two-period dynamic model equilibrium and originate that technical analysis has very important place and value in the economy where investors are of myopic mindset. In the economy where investors are rational and want to do numerical analysis, one can find that by using weighted average, second period price dominated as an informative source over the first. It has been found that investors used historical prices as compared to current prices and gave importance to technical analysis.

Brock, Lakonishok & Lebaron (1992) has analyzed the research with the use of two trading rules which are widely accepted and simplest namely moving average and trading range break-by utilizing the Dow Jones Index from 1897 to 1986. Extension of standard statistical analysis has been done by applying bootstrap techniques. Overall, it has been concluded that results of the research provided robust support to the technical strategies. Furthermore, results showed that with the application of technical rules, higher returns were generated by buy signals as compared to sell signals and returns of buy signals were less unpredictable when compared with sell signals.

Blume, Easley & O'Hara (1994) has examined the importance of role of volume and its application for providing information when using technical analysis. New equilibrium model has been established considering aggregate supply to be fixed which helped traders to collect the signals with varying quality. Volume is helpful in providing material on the quality of information which was possible to collect with the use of price statistic. It also helped to know the relative factor of price movements, volume and information precision and indicate the sequence that is informative. It has been found that the traders got better results by using technical analysis.

Antoniou, Ergul, Holmes & Priestly (1997) in this study argument regarding technical analysis was that it can be predicted well when used on the basis of both volume as well as return. In this study researcher has used data of daily closing prices of companies based on individuality. It has been found or the result revealed that technical analysis performed better with both volume and past returns.

Cheung & Wong (1997) in this article has assessed the execution of filter rules on the currency exchange rates of Asia against the American dollar. Numerous Peril allergic variables and the conditional variances GARCH are accustomed to exemplify devastation of risk premium adjustment on filter rule appraisal. These Asian Pacific Financial markets are Japan, Malaysia, Singapore and Taiwan. Results shows that it is salient to contemplate the peril from the stock holder's viewpoint for assessing trading rule profits and moreover higher-ranking performance of filter rules announced in the literature. Most importantly there is no basic dissimilarity in the filter rule trading and buy and hold strategy.

Mills (1997) has investigated the technical trading rules on London Stock Exchange (LSE) from 1935 to 1994. He has used moving average oscillator and bootstrap technology on the data. He has culminated that the technical rules play an important part for producing the extra return over the normal buy and hold strategy. In most of the faces he established that the impact of technical analysis is very much in strength. Up to 1980 the performance of technical analysis is extremely in power though from 1980 onwards the buy and hold strategy is found to be more than the active strategy based on the techniques of technical analysis.

Bessembinder & Chan (1998) has conducted the study on Dow jones industrial averages and has applied 26 rules of technical analysis that includes variable length moving average, fixed length moving average and trade range break. He has taken the data from 1926 to 1991 and when applied all the data, he concluded that the predicting power of technical trading rule is not only because of the inefficiency of the market. He further concluded that the result of the study can be useful for the investor and the recombiner result of brock remain interesting and unresolved.

Brown, Goetzmann & Kumar (1998) in this paper investigated the watershed study of Hamilton and analysis was done by Alfred Cowles' (1934) which pave the way to

random walk hypothesis and played an important role for the evolution of efficient market theory. The contribution of this research is not simply to manifest that Hamilton was a successful market timer.

Gencay (1998), in this paper has estimated the expediency of technical rules grounded on multivariate statistics that augment complete payback of an outlay approach. This expedience was assessed to a simple strategy named buy and hold. It was concluded that with the help of simple model that significant excess returns can be generated over buy and hold strategy when multivariate models are used with technical rules after considering transaction costs.

Mizuno, Kosaka, Yajima & Komoda (1998) in his study has investigated the data for TOPIX. The researcher has used the statistic named neural network in order to predict the security market and then try to find out the proper timings for buy and sell in the market. The researcher has used the weekly data for the selected indexes. Data for 260 weeks have been used for the time period from September 1982 to August 1987 and then prediction model have been developed and further the data for 119 weeks was taken from October 1987 to January 1990 for evaluating the model. To draw out the index pattern a total of 11 technical indexes of TOPIX are chosen. It was concluded that Experimental Simulation has generated better results as compared to the returns retrieved by the one-time use of every technical index.

Allen & Karl (1999) in this research, he analysed base cases and confirmed that trading rules gave positive signals when genetic algorithm was put on wide security indicator. He also concluded that these algorithms could get better results when used in liquid markets as well with short transaction costs, counting financial futures, commodities and foreign exchange markets.

Fyee, Marney & Tarbert (1999) in this research has explored the prospect that technical trading rules which have extensive pertinence and plausibility with investment experts, could make nimity profits. In order to recognize and examine the trading rules, Genetic Programming techniques were used. It was discovered that rule was better than simple buy and hold and further concluded that he did not find sufficient ground to neglect efficient market hypothesis.

Chan, Hameed & Tong (2000) in this study examined the profitability of momentum strategies structured, based on past returns of country indices in the universal equity markets. Equity market indices for Malaysia, Thailand, Taiwan and Indonesia was taken from the PACAP data tape while the remaining equity indices are taken from Data stream. The analysis is conducted based on stock indices dominated in U.S. dollars. Results indicate proofs of momentum profits that are statistically and economically suggested, particularly for short holding periods (Less than 4 weeks). This paper concluded with an interesting topic for future work i.e., the relation between trading volume and price continuation (or price reversal) and difference between individual stocks and the market.

Maillet & Michel (2000) in this paper enlarged tenor outcome regarding technical analysis efficiency on the foreign exchange market. He endeavors to ascertain whether percolating the sequence of raw exchange rate with some trading rule possibly swap its attributes. In this paper, bootstrap methods were used due to the irregularity of exchange rate sequence. These techniques were applied on the foremost daily rates of exchange since 1974 in order to technical analysis achievement. It has been concluded that these chartist returns are substantial high up than the naïve ones for several series and for a large span of variables. It was suggested to use filtering properties to get better performance out of technical analysis.

Lai, Balachandher & Nor (2002) in his study investigated the forecasting capability of trading rules that are technical in nature on daily basis. The study was conducted on “Kuala Lumpur Stock Exchange Composite Index.” Sample taken for the study was from January, 1977 to December, 1999. To check the random walk model two tests were applied on the returns of the market. It was concluded that the 60- day (FMA) Fixed Length Moving Average and (VMA) Variable Length Moving Average rules are found to be most profitable i.e. these generate returns that are significantly higher than the unconditional mean return of the buy-and-hold strategy.

Ready (2002) has investigated the forecasting capability of returns on daily basis for Dow Jones Industrial average by making comparison of trading rules studied by Allen (1999) and Brock (1992). The study supported the rules developed by Brock (1992).

He was of the belief that if the results were reliable then in order to improve their returns, investors will use technical analysis as compared to historical data.

Baccouche & Kouki (2003) in his study focused concentration on the awareness of technical inefficiency to most frequently used partial distributions of the incompetence error term which are named as exponential distributions, half-normal and truncated normal. It has been found that absence of technical inefficiency is wrongly rejected. The predicted inefficiencies advice that the efficiency average rate of 92% and 72.5% can be produced with the use of models that are exponential and to a lesser degree, namely the truncated normal, the half-normal, and the exponential distributions. It has been found that absence of technical inefficiency is wrongly rejected. It is also found that Tunisian firms which are based on truncated normal, had been inefficient with an average rate of inefficiency around 40% approx.

Dawson & Steeley (2003) in this paper has replicated and extended the work of Lo et al. (2000). For this the researcher has used the data on U.K market. He recognized the patterns of technical trading using regression of Kerhel. Two non-parametric tests were used namely chi-square test and Kolmogrov-Smirnov test. It was found that the results showed less support to technical trading rules.

Rodriguez F. Rivero S. & Felix J. (2003) in this research assessed the impact on the economy of non-linear forecasting capability of European monetary system exchange rates. He used daily data for nine currencies of EMS from 1st January, 1978 to 31st December, 1994 period. The researcher used two predictors that are nearest-neighbor (NN) and simultaneous nearest neighbors (SNN). He considered nearest neighbor non-linear predictors, converting their predictions into a technical trading rule, whose expediency has been evaluated against the classic moving average trading rules, bearing in mind both interest rates and transaction costs. It has been found that in most cases, a trading rule based on a non-linear predictor beat the moving average, both in terms of returns and in terms of the idyllic profit and the Sharpe Ratio profitability indicators.

Thawornwong, Enke & Dagli (2003) in this research, to provide base to the robustness of the model of neural network, has tested three stocks across different market industries. It was found that in order to predict the security behavior in future,

they were interested to apply indicators namely neural networks and technical analysis. The results concluded that predictability power of profitability guided by NN is higher than that of their benchmarks.

Wong, Manzur & Chew (2003) in this research, the researcher tested two most frequently used techniques on daily closed price of Singapore for total period of 21 years starting from 1st January, 1974 to 31st December, 1994. It was found that both techniques ‘Moving Average’ and ‘Relative Strength Index’ produced best results and RSI depicted better results by using the method of ‘50 crossover’ rule.

Achuthan & Anubhai (2005) has examined the forecasting capability of technical analysis rule in Bombay Stock Exchange Sensex index. He has considered the period from 1st February, 1991 to 5th March, 2003. For the study, moving average technique was used applying both short-term and long-term variable moving average. Among both techniques, it was found that short-term is beneficial and has predicting power. Researcher supported the fact that if transaction cost is more than 1% then long-term moving average is better than short-term.

Maillet & Michel (2005) in this paper expanded previous results of “US dollar” exchange rates when technical holding rules were applied on this market and proven profitable. It was found that two statistics or test were used to determine the level of significance of European currencies. These tests were Parametric and Non-Parametric. The results concluded that the use of technical analysis was not profitable for the European currencies.

Metghalchi (2005) in this paper, the researcher investigated “S&P 500 Stock Index” by applying three moving average trading rules considering the time period 1954-2004. It was found that the result generated has been categorized in two market periods i.e. market inefficiency and market efficiency. From 1954 to 1984 market inefficiency was predicted signifying that the results were stable during this period and from 1984 to present, it was found that the market was efficient.

Hassan, Haque & Lawrence (2006) the researcher made a study on the top seven emerging stock markets of Europe as classified by International Finance Corporation as arising markets. The study has found the correlation among the different stock markets alongwith U.S. and U.K. markets. He has also studied the market efficiency

and auto correlation among the markets. The study has used the weekly data and found that the portfolio benefits can be obtained from equities of Slovakia, Turkey and U.S. Further, the study supports that returns for Greece, Slovakia and Turkey were unstable over time. The study concluded that European emerging markets overall are not predictable and there is correlation among the emerging European markets.

Sundhar & Kakani (2006) in this paper the researcher tested the weak-form efficiency of Indian equity markets by employing the Simple Moving Average (SMA) and the Displaced Moving Average (DMA) on the S&P (NX Nifty, BSE Sensex for a time period of 15 years from 1991 to 2005 in Indian equity markets. It was found that both the moving averages were successful but the DMA indicator was highly successful.

Balsara, Chen & Zheng (2007) the researcher conducted considerable academic research on the effectiveness of technical analysis of the security and future markets. For the purpose of this research, the index of daily stock prices for class A and class B shares trading on both the Shanghai and Schengen stock exchanges have been analyzed. In this paper, Ex-post forecasts of daily prices has been generated by using a native forecasting model and an Auto-regressive Integrated Moving Average (ARIMA) model. It has been found that Chinese markets were more volatile than their counterparts in either Hong Kong or Malaysia. Moreover, we found that ARIMA forecasting model generated more accurate forecasts as compared to the native model which assumed that prices follow a random walk process. Thus, it suggested that technical trading rules have played an important role in the Chinese Stock Markets.

McKenzie (2007) has constructed the work using the technical trading rules on seventeen emerging markets. He has used three rules of technical analysis that are Variable Length Moving Average, Fixed Length Moving Average and Trade Range Breakout. His findings were that when comparison was made between emerging markets and developed markets regarding yields, emerging markets generated higher returns. Further, the work has resulted that the time period was divided into pre-currency crises and post-currency crises. During pre-currency crises buy signals were

greater as compared to sell signals but during post-currency crises proportion were same of both the signals i.e. 1:1.

Park, Chel-Ho & Irwin (2007) has made a detailed investigation with regard to the profitability from technical analysis. The researcher has investigated a lot of studies in order to find out the evidences from the learnings about the profitability of technical analysis. The total paper has divided all the studies into two parts which named as early studies and modern studies. The modern studies are taken from period 1988 to 2004. The result of the early studies stated that the profitability of the analysis which are technical in nature can be found in case of foreign exchange and futures markets but not in case of stock markets. In case of modern studies, it was found that a consistent profit can be found in case of speculative markets. Out of 95 studies, 56 have supported favorable results, 20 studies supported unfavorable results and 19 studies have shown the mixed results for technical analysis predictability. Eventually, it was concluded that technical analysis can be cast-off for predicting markets but many of the researcher were of the view that technical analysis was not always the best technique for predicting the markets.

Chong & Ng (2008) has investigated the two rules of technical analysis which were ‘Moving Average Convergence and Divergence (MACD)’ and ‘Relative Strength Index (RSI)’ on the data of “London stock exchange”. The author has taken the data for 60 years and found that both the rules have the predictable power. The study has clearly stated that the active strategy using these directives can effortlessly surpass the buy-hold strategy for the study period. So, the study was very much in support of the evidences that an investor can use these rules in order to generate the better return over the buy-hold strategy.

Fifield, Power & Knipe (2008) in this paper examined two markets which are emerging and developed. It has been found that the researcher has taken into consideration emerging markets that are 15 in numbers and number of developed markets was 3. The study has been conducted on January 1989 to December 2003. Furthermore, moving average rules were used to examine these markets. The results concluded that these rules were lucrative in emerging stock indices compare to developed market indices.

Terrence Tai-Leung Chong & Wing-Kam Ng (2008) in this paper the researcher analyzed the 60-year data. Data was collected from July, 1935 to January, 1994. It was found that data was collected to examine the profitability of rules in London Stock Exchange FT30 Index. Rules which were taken in consideration to check the profitability- Moving Average Convergence Divergence, Relative Strength Index and buy and hold strategy. Results concluded that RSI is better in generating greater returns than buy and hold strategy.

Eric, Andjelic & Redzepagic (2009) in this paper has emphasized on the development of investment approach. It was found that in order to achieve this objective researcher has used technical analysis as a measure on the money market of the democracy of Serbia. Further, it was observed that mainly two indicators were used like MACD and RVI to the stocks. Researcher has taken into consideration the period between June, 2004 to May, 2008. Mainly he focused on financial market. At last, the result concluded that these indicators were committed to investment approach for the development in financial market.

J.L. Bettman et al. (2009) in this paper has analyzed the competency of two analysis which are mainly used i.e. fundamental and technical. Researcher has used these analysis to analyse the share prices. It was found that the literature over cited the feasibility that these analysis could deliver as accompaniment instead of substitute in equity appraisal. To bridge this gap an equity valuation model has been used with both these fundamental and technical analysis. This test confirmed the appreciative nature of both these analysis and has inferences in the context of other valuation exercises.

Krausz, Lee & Nam (2009) has made a study on security markets which includes Japan, Australia, Indonesia, Hong Kong, Korea, Malaysia, Singapore, Thailand and Taiwan stock markets. The study considered the data started from 1970 to 2007 for the various stock markets on average basis. The study showed that the vital process of daily Stock Exchange returns was featured by non-linearity appearing from an asymmetric reverting property. It was also found that this property of stock returns is useful in generating good signals (buy and sell) for trading rules. The study concluded that out of nine markets eight markets can be better predicted and can create better

return by using the technical rules. The only market which cannot be predicted or was not possible to generate the better return in case of Korean stock market.

Kung & Wong (2009) has investigated the three important rules of technical analysis in the Singapore market. Three technical rules were used in the market. Data was collected for pre-crises from 1988 to 1996 and for post-crises from 1999 to 2007. Thus, equal time data was taken for both the periods. The study found that the function of technical analysis was immensely in pre-crises period but during the post-crises period the role of technical analysis was not found very significant. So, the study at last concluded that after the Asian crises, measures taken by the Singapore government has resulted the increase in the efficiency of Singapore market.

Lamartine & Adriano (2009) in this paper assessed the possible use of technical analysis namely, stop gain, stop loss and RSI filter to compare profitability with buy-and-hold strategy. The study was conducted to predict price trends in the security market. Researcher implemented the rules for comparison on 15 stocks and found that 12 stocks out of 15 have performed better when measured with buy-hold strategy. So, researcher believed that with this approach, he can predict the real short-term stock trend.

Metghalchi, Du & Yixi (2009) has made a study to test the predicting ability of four security markets which were Taiwan, Hong Kong, South Korea and Singapore. He has used four moving averages namely 1-50, 1-100, 1-150 and 1-200. He has found the strong evidences that the moving average can beat the buy and hold strategy in these markets. He also tested the results by using the t-test. He found that the both buy and sell signal as resulted by the moving average has significant differences with that of buy and hold strategy.

Mizrach & Weerts (2009) in this paper with the behavioral finance literature attempted to describe what prompted investors to trade. It was found that the researcher focused on the daily frequency, rather than weekly as the breaching of “n-day highs or lows” is a daily event. In equity analysis, “n-day highs and lows” seem to be important for traders and investors. And it has been discovered that there is positive relationship between abnormal turnover and the event of breaching both “n-day highs and lows.”

W. Cheung et al. (2009) the researcher investigated the effect of market assimilation in the market of Hongkong by applying trading rules. It was found that two rules used were “Simple Moving Average” and “Trading Range Break”. In this research time period of 35 years starting from 1972 to 2006 has been considered. Further it was found that the result generated with these rules were precise. The result supported the conjecture that security market integration may lead to better information efficiency. The results of TRB rules were irrelevant over the 35 years span. Overall, it has been found that technical analysis was relevant for asset pricing.

Ward & Terblanche (2009) in this paper extended the work by scrutinizing the risk and return outcomes. It was found that returns which were scrutinized were of market timing approach. Further the researcher has used portfolios of ‘Rand-Play’ and ‘Rand-hedge’ shares.

Coutts (2010) in this paper re-examined the work of Coutts and Cheung (2000) who investigated the validity of trading rules in the Hang Seng Index (HSI) on the Hong Kong Stock Exchange (HKSE) for the period January, 1985 to June, 1997 and it was found that these regulations or rules were rigorously notable over small data period than used in the earlier works. This article has probed the applicability and validity of trading rules in the HSI, employing daily returns over the period 01st July 1997 through 30th April 2008 and two sub-samples of equal length and concluded that both the MA- Oscillator and the TRB appear to be unimportant for the sample and two sub-samples. However, it has been found that when these rules are re-appraised in subsequent periods, they appear defunct.

Lai, Chen & Huang (2010) has investigated the most widely used rules of technical analysis namely moving average and trade range breakout on the companies which are listed on Taiwan stock exchange from 1987 to 2008. The study took into consideration the disposition, information cascade and anchoring effect on the forecasting capability of technical trading rules. The study found that these three have significant impact on the trading signal. The study also concluded that though some trading rules may generate higher returns in some cases but in general the technical rules return cannot outperform the return of buy and hold strategy.

Marshall & Cahan (2010) has analyzed the indices of markets (49) that were arising and developed, taking into consideration the trading rules which were more than 5000 in numbers in order to investigate the yielding power of these rules with the help of Morgan Stanley Capital Index and to experience whether these rules build on the value around the world. The finding was that technical analysis resulted better in emerging markets, than in case of developed markets, and was consistent with literature which documented that these markets were less efficient. He further concluded that number of evidences were less supporting to the fact that these rules can generate the better return in all cases and he also stated that the role of these rules is not adding much value to the results.

Yen & Hsu (2010) examined the profitability of 8061 technical trading rules in ten future markets comprising financial and commodity elemental assets based on the SPA test (test for superior predictive ability), Sortino and Reversed Sortino ratios. It was found that these tests and ratios were not able to beat the benchmark strategy i.e., buy-and-hold and suggested that two recently developed statistical techniques, the stepwise reality check (SRC) and the stepwise test for Superior predictive ability (SSPA test) might add to this issue.

Čaljkušić (2011) has investigated the rules which can be used by the investors in taking the right decision for the investment in the stock market. The study was conducted on Zagreb stock exchange (ZSE). The study also considered the impact of turbulence of global economy on the ZSE. The paper explained the situation in which one can use the fundamental and technical analysis. The paper also concluded that psychology and happiness of the investor is one of the most paramount elements that one should consider and technical analysis can be used depending on the specific situations.

Chitra (2011) has made a study on selected stock in Indian stock markets related to the energy sector. The data was taken for 10 companies which were actively traded in Indian stock market. The companies were selected based on stratified sampling. Data was taken from April 2007 to March 2010. Researcher has used Simple moving average, RSI, and beta in order to test the collected data. Researcher discovered that the techniques of technical analysis can be used in Indian stock market. The

researcher concluded that the investor can have a better understanding of stock if he uses technical analysis. It was further suggested that the small investor must not make the investment blindly in the stocks rather they must use some tools with a view to have a superior understanding about the time and purchase decision in the market.

Pauwels, Inghelbrecht, Heyman & Marius (2011) in this research, investigation of thirty-four arising markets was done to study the efficacy of the trading rules that are technical in nature with the help of Hansen's test to check the Superior Prognostic Ability and White's check of Reality and comparison was done with buy and hold benchmark. Findings of the work revealed that trading rules can achieve superior results if stock markets are inefficient. Here, 4 out of 34 emerging markets are significant for trading rule profits.

Raissi & Zakizadeh (2011) has conducted a study to find out the most profitable strategies and techniques of technical analysis. The study was conducted on Tehran stock market. Top 20 companies of Tehran stock market had been taken. The data was taken from 21st March 2001 to 21st June 2010. In total 16 techniques of moving averages were taken into consideration for the analysis of data. Out of 16 techniques 8 were related to the simple moving average and other 8 were related to exponential moving averages. In the conclusion the researcher believed that moving average can be used as a better technique in order to give rise to superior returns over buy and hold benchmark. The best moving average was found to be 1-25 over all other as it has generated the return of 123.87% with surplus return of 104.4% over the buy-and-hold strategy.

Denis, Zoran & Jurica (2012) has conducted the study on S&P 500 for the time horizon of more than 70 years. They have taken the data from 1950 to 2012 and then apply the dual cross over exponential strategy on the data. They have used EMA 50-200 strategy to find out the benefits and predicting power of this technique on the data set. In this study they have found that in case of long- time frame or tenure the buy-and- hold strategy have superior hand over EMA. They have found that when the data is analyzed at a stretch from 1950 to 2012 buy and hold have given the better return (7.40%) over the EMA (6.81%). But when the data is analyzed in blocks of ten years then EMA is found to be better in some cases. At last, they have found that in case the

market has a non-professional bull market then buy-and-hold seems to be a good strategy but in case the market has secular range bound market then in such case EMA seems to be the best strategy over the buy and hold. The study further suggested that the buy- and-hold strategy will be beneficial if the investor has a very long- time horizon such as for pension funds and a young investor is planning for the retirement. But in case you are an active investor and market is range bound then you can have very good return by using EMA.

Metghalchi, Gomez & Chang (2012) has analyzed 9 popular technical indicators to examine the lucrativeness and hazardousness of numerous trading rules with buy and hold strategy by using 66 models from November 15th ,1990 to August 16th , 2010 on security index of Taiwan. Results give full assistance to the forecasting capability of trading rules. Further it is also revealed that in order to find the results, moving average 50 is the best model when used with relative strength index.

Pandya (2013) made a study to investigate how much the techniques of the technical analysis can be beneficial in case of IT sector in India. The researcher has taken top five companies of IT sector. The data was taken for all the five companies from 1st April 2010 to 31st March 2012. Daily price data of the respective stock were taken. On the collected data the researcher mainly used Exponential Moving average (EMA), Simple moving average (SMA), Moving average convergence and divergence (MACD), Relative strength index (RSI) and Rate of change (ROC). The data was analyzed and researcher believed that stock prices of companies taken in the study can be very well predicted if techniques of technical analysis were used. Further researcher's opinion was that charts can be the basis to study the future trend and can easily be used as a guiding tool for the investors.

Rosillo, Fuentea & Brugos (2013) has made a study which is conducted on Spanish stock exchange. The study has considered the four most important and widely used rules of technical analysis which are RSI and MACD. Period from 1986-2009 was taken into consideration on which the study was conducted. The study divided the total data period into eight sub period and used the rules on these periods. The research discovered that trading rules which are technical in nature can help to generate the superior results or may have more yielding power than buy and hold

strategy and can give the signal to the buyer over buy and sell decision in market for all sub periods. The study further concluded that RSI is the better rules and can be used in many markets.

Tilehnoei & Shivaraj (2013) has made a study to investigate the comparative edge among the two most important technical analysis rules i.e., Relative Strength Index and Moving Average Convergence Divergence. Time period for data collection was from April 1st, 2010 to May 24th,2011 on HDFC Bank Ltd. Study was based on secondary data and the data was taken from the website of money control.com. To make a comparison one performance index was also calculated. In the conclusion it was found that the performance index of MACD was found to be 9796.68 and the performance index of RSI was found to be 9038.09. So, in nutshell it was concluded that MACD was a better technique as compared with RSI but the study also supports that RSI is also a good technique in case of overbought and oversold market conditions.

Boobalan (2014) has carried out a study on the five companies of Indian stock market. He has used stratified sampling in order to select the five companies. The data was taken from February 2011 to March 2014. The data was taken from NSE and other Journal of the respective companies. In the study researcher has used EMA, Candlestick Chart, MACD and RSI to test the rationality of technical analysis in Indian security market. In conclusion the researcher has concluded that the stock prices of the can be predicted if proper tool of technical analysis is used. The researcher was also of the opinion that the knowledge of fundamental analysis is also important in case the researcher want to use the technical analysis more effectively. So, in nut shell the researcher was the supporter of using both the analysis that are fundamental in nature and as well as technical to have a clear picture if investing in security market.

Chong, Ng & Liew (2014) has made a study to test the conduction of Moving Average Convergence Divergence and Relative Strength Index on five countries out of the OECD countries. The study performed as revisiting the rules of MACD and RSI on these five countries. Earlier study conducted by Chong and Ng in 2008 with the same rules on the data of London Stock Exchange was the basis of this research.

The five indexes were considered in this study. Data was collected from January 1976 to December 2002. When the rules of MACD and RSI was applied it was found that RSI crossover has the predicting ability in Italian and Canadian stock exchanges. RSI centerline crossover rule is found to be better in many cases. MACD was also found to be profitable in many cases. So, in nut shell the researcher has concluded that both MACD and RSI can be useful in predicting the stock market. The study further motivated that the research can be done on individual shares.

Gang & Jin (2014) has conducted the study in Chinese stock market for the period from January 1st, 2003 to January 1st, 2013 on 2139 stocks of the Chinese stock market. He has considered the volume-based information rather than the information of the normal prices on these stocks. He has used volume based moving average and then used the moving average on this information. He has taken four criterions in his analysis which includes sensitivity, reliability, risk, and benefits. He made a comparison and found that the volume based moving average can give the better return over the normal moving average which we normally use on the closing prices of the stock prices.

Hoffmann & Shefrin (2014) examined the impact of using the technical analysis rules on the return of individual investor. The study was conducted on the investors taken from the Dutch discount brokerage clients. The study was made on the data from 2000 to 2006. The study investigated that how the individual investor used the technical analysis in their investment decision. The object of the research was to discover if investors were benefited by using technical analysis. The research resulted that the investors using technical analysis was not benefited or one can say has earned the lower return as compared to the normal investor after using technical analysis rules. The study further explained that the objective of the investor tends to be more of short term than the long- term investment. The average return by using technical analysis was found to be 50 to 70 basis point lower than the normal return.

Ijegwa, Rebecca, Olusegun & Isaac (2014) has made a very detailed investigation by using four important techniques of technical analysis which consists of 'Moving Average Convergence Divergence (MACD)', 'Relative Strength Index (RSI)', 'Stochastic Oscillator (SO)' and 'On Balance Volume (OBV)'. All techniques were

used on data bank of two Nigerian markets. The experiment is carried out for two months. The fuzzy system was developed by the researcher and then the actual data is compared with that of the data collected and analyzed as per the various techniques and fuzzy system. The researcher was of the view that there can be satisfactory signals of buy and sell for the markets under study.

Nithya & Thamizhchelvan (2014) investigated the effectiveness of technical analysis in case of some selected banking sector companies. The researcher has used candle-stick chart, MACD and RSI technique on the data set. The data was taken from January 2013 to 20th February 2014. Techniques were applied on the data set. In the conclusion the researcher believed technical analysis can be beneficial for the investor. The investors can use the appropriate technique in case of technical analysis and can generate the better return. The three companies that were taken in the study consist of CAN BK, IDBI, ING Vyasa Bk. The data was taken from the website of NSE.

Nor & Wickremasinghe (2014) has conducted the study on Australian security index from 1996-2014. He has conducted the study on these 23 years data after dividing the data into four sub periods. He has used two rules of technical analysis i.e., Moving average convergence and divergence (MACD) and Relative strength index (RSI). Study concluded that the result of MACD were not very much supportive towards the predicting ability of stock market but the results of RSI was very much in consistence with the remark of predicting power of technical analysis.

Sahin & Ozbayoglu (2014) has made a study to develop a model of trading by using the base of RSI technique. The study was an attempt to identify the performance of the developed model when equated with the buy and hold strategy along with RSI without using the model as developed by the researcher. The model developed by the researcher is named as TN-RSI model i.e., Trend normalization RSI model. Nine ETFs were selected and data was taken from 27th March 2008 to 31st December 2012. When the performance of the model was equated with buy-and-hold strategy and with normal RSI technique it was found that model has the better possibility of generating the returns as compared with the other two. The concluding remarks of the researcher was that RSI can perform well in case of trendless market or bull phase of market.

The TN-RSI model perform better in every situation and has the greater potential of generating return over the B&H and RSI.

Talreja (2014) has made a study to find out how profitable Relative Strength Index (RSI) can be in case of investing in the securities. The Predicting power of RSI was tested for five companies named Tata Steel, SAIL, Reliance Infra, SESA and Maruti. The data was taken from April 2006 to March 2011. The data was analyzed using RSI and it was found that RSI can be used to predict the prices of the stocks. The remarks from the author are that it is not 100 percent chances that market can be predicted but there are a lot of chances that markets can be predicted.

Zakamulin (2014) has investigated the performance of some most popular technique of technical analysis. The study was done on four major indexes including S&P composite index, Dow Jones Industrial Index, Two indexes of US bond market. The data was taken from January 1926 to December 2012 a total data of complete 87 years. An average of 1044 observations on monthly basis are analyzed. The conclusion of the study was that the return generated by the techniques of technical analysis as stated by the previous study was found to be overstated. The real return generated by the techniques are very less and the return generated by using techniques cannot out perform the B&H return. The time if taken as long term or medium term then the return generated by the techniques are very less.

Anghel (2015) has conducted one of the widest studies on the data of 75 countries. Data was collected from January 1st 2001 to December 31st 2012. He has used the technique of MACD and used this rule in two senses which were one in case when the MACD is higher than zero go long and other the normal signal given by the rule. He has found that there are some anomalies in the market and he has not completely rejected the EMH and give a new concept of AMH in his work.

Ghobadi & Ghobadi (2015) has used one of the most unique techniques in the technical analysis named TOPSIS. In this technique one tries to rank the technical rules based on their return generation in the stock exchanges. Researcher has used six rules of technical analysis which includes MACD, RSI, Simple moving average, Stochastic Oscillator, Commodity channel index, Money flow index. The researcher has made the study on the ten listed Dow jones companies from 2009-2014. The study

supported that all technical rules can generate the better return as compared with the normal trading strategy. The best rule was found to be MACD with the mean value of 1.

Kresta & Franek (2015) has made an investigation to find out the profitability of analysis that are technical in nature of checz stock market. The researcher has taken the data set from September 7, 1993 until July 20, 2015. Data set was downloaded from checz national bank. The researcher has used moving average technique and develop an automated trading system to judge the efficacy of the technique. He also found the net wealth creation by using the technique and automated trading system. It was found in the study that automated trading system have made a better return over the normal buy and hold approach. The wealth creation by automated system was more than 2 times of normal buy-and-hold strategy. So, it was stated that technical analysis can be used for better profitability.

Tharavanij, Siraprapasiri & Rajchamaha (2015) has made a study on five Southeast Asian stock markets. The study includes five countries which were Thailand, Malaysia, Philippines, Singapore, and Indonesia. The data was taken from January 2010 to December 2013. To test the efficiency, researcher has used five techniques. These five techniques are Relative strength Index, Directional Movement Indicator, Stochastic Oscillator, On Balance Volume techniques and Moving Average Convergence and Divergence. The efficiency was tested by comparing the returns of technical analysis with that of benchmark index i.e., buy-and-hold. Thailand was found to be the most predicted market and Singapore was found to be the most unpredictable market. He also emphasized on the fact that the transaction cost is one of the most important elements that can put a negative impact on the return earned by using the techniques of technical analysis.

Zhu, Jiang, Li & Zhoua (2015) examined the lucrateness of trading rules that are technical in nature in case of stock exchange of China. Data was collected for two most famous indexes of China. Data of Shanghai Stock Exchange Composite Index was collected from May 21st, 1992 to December 31st, 2013 and that of Shenzhen Stock Exchange Composite Index from April 3rd, 1991 to December 31st, 2013. The two most important rule 'Moving Average (MA)' and 'Trading Range Break (TRB)'

were considered for the study. The study concluded the remarks that the return by using the technical rules can be better when compared with buy and hold strategy if investor ignores the transaction cost. But if transaction cost is considered then technical rules used in the study cannot generate the better return as compared with buy and hold strategy.

Gerritsen (2016) has investigated whether the technical analysis can perform better abnormal return in stock exchanges or not. The study was conducted by taking the eight important technical rules including moving average, moving average crossover, Bollinger bands, MACD, RSI, Rate of change, trading range breakout, on balance volume. Data was collected from November 2003 to December 2010 on Dutch Stock Exchange. The study was concluded with the remarks that the technical rules cannot generate the abnormal returns in the stock markets. The study suggested that the trading based on technical rules recommendations cannot be used in order to generate the better returns.

Hayes et.al (2016) had made a study to investigate the impact of assets condition and time horizon on the profitability of the stock by using technical analysis. The study was conducted on 296 stocks over the time horizon of 15 years. The data was taken from 1997 to 2012. The techniques of technical analysis which were used in the study includes Adaptive Moving Average, Moving Average, Bollinger Bands, KDJ and Commodity Channel Index Moving average, Adaptive moving average, Bollinger Bands, KDJ and Commodity channel Index. The findings of the work stated that the technical analysis can be beneficial in order to earn extra return consistently. The study also concluded that the assets conditions are very much important in case of technical analysis. The time horizon is also important in technical analysis. The researcher has concluded that 87% of the stocks taken in the study has depicted better return over the buy-and-hold strategy.

Singla R & Malik N.S. (2016) has investigated the role of EMA as technical analysis. Researcher has taken the data for twelve markets of the world which consist of both emerging and emerged markets. The data was taken for sixteen years. In the study the researcher has used 'EMA 5-20' technique on the data set. The analysis was done in two phases which includes the analysis of whole data at a single instance and

analysis is done in four block of four years. The study concluded that in most of the cases the Singapore and Russian market can generate the better returns over the benchmark strategy i.e., buy and hold. Returns generated by using the active strategy has beaten the return of buy and hold approach in several markets but some in case of long and short strategy. The researcher concluded with the remarks that the markets can be predicted by using the EMA technique on the data set but the timing and efficiency of the market must be checked before using the EMA.

Bhargavi, Srinivas & Anith (2017) has made a study on 20 companies in Indian stock market. The 20 companies were selected on the basis of earning per share and price- earnings ratio. based on EPS and PE ratio. In this study he used Relative Strength Index (RSI) technique to evaluate the efficiency of RSI in Indian Market. The data was taken for 2011 to 2013. The researcher has used the 70:30 cross over rule with the 14 days value in order to use the RSI technique. In the study it was found that RSI can be used very effectively in Indian stock market. In most of companies RSI predicts the both buy and sell signal very effectively and then it is very much helpful for the prediction of future prices in case of these 20 companies. Further the researcher has also concluded that for predicting profitability price-earnings ratio is good indicator than earning per share. In the end the study was concluded with the remarks that RSI can be used for effective portfolio construction.

Masry (2017) has conducted the study on Egyptian stock market for the time period from 1995 to 2015. He has conducted the study on 46 companies' shares of Egyptian stock market. Six rules of moving average were used consisting fixed and variable length moving average. When he has analyzed these rules on the data, he found Egyptian security market can be forecasted and the technical rules can produce the better return over the buy and hold strategy. He also concluded that there was inefficiency in the Egyptian stock market.

Almujamed, Fifield & Power (2018) has conducted the study on Kuwait stock exchange. He has taken the data from 1998 to 2011 on 42 firms which was listed in the stock exchange. All 42 firms were classified into seven sectors. He has tested weak- form of efficiency in the Kuwait stock exchange and used the filter rules on the data. He has concluded that in most of the cases the filter rules were not able to

generate good returns over the benchmark buy and hold strategy. He further concluded that out of seven sectors; banking sector is most efficiently priced. The transaction cost also does not have any significant effect on the applicability of technical trading rules.

Aggarwal, Khan & Shukla (2019) had made a study to find out the efficiency of a new model named Long Short-Term Memory, Deep Learning and Stock Technical Indicators (STIs). The model was applied to stock prices of three banks which are HDFC, Yes Bank and SBI. The data was taken for two years starting from 16th Nov, 2016 to 15th Nov, 2018. The researcher believed by using some specific models on the various techniques of technical and/or fundamental analysis can generate the better return. The researcher also put the highlights to take the buy and sell timing by using the model. The conclusion of the research showed that the mean accuracy of the model found to be 59.25% over the many stocks.

Agustin (2019) has made an investigation in analyzing the predictive capability of both fundamental and technical analysis. He has conducted the study on the companies which were registered in composite stock price index and incorporated in LQ45 stock. Data was taken for all those companies which were listed on LQ45 stock for the period from 2007 to 2016. The researcher has made the study in three phases i.e., using only fundamental analysis, using only technical analysis, and last using both analyses i.e., fundamental and technical for the prediction of stock markets. Out of three models developed by the researcher the technical analysis model shows the highest predictive ability and after that the combined model shows the predictive ability. So, the researcher was of the view that one can use either the technical analysis model or both fundamental and technical analysis to make prediction of stock markets.

Mudgal (2019) has tried to find out the effectiveness of technical analysis for predicting the security market with one more tool known as sentimental analysis. The researcher was of the view that the past prices analysis along with the sentiments of the investors which were created by the news and various other sources can be used to forecast the stock market prices. Researcher has built a web crawler that will create a signal by automatically downloading the important information and then will give a

signal for further action. In the conclusion the researcher has concluded that the prices can be predicted and more techniques of technical analysis can be used for prediction purpose along with the sentimental analysis.

Nti et al (2019) attempted to make deep analysis for the researches that were done during a period of eleven years starting from 2007 to 2018. A total of 122 research articles were studied and it has been found that out of the total studies 66% studies are based on techniques of technical analysis, 23% are based on fundamental analysis and rest 11% are based on the combination of both type of analysis. The researcher has also used the number of resources used in the research. Out of the all researches 89.34% have used single source, 8.2% have used two sources and rest 2.46% have used three sources in the research. When talked about the techniques the researcher has find that artificial neural network seems to be most used techniques during the period of the study of 11 years.

Shah D., Isah H. & Zulkerninr F. (2019) has made a deep investigation to make a review of stock markets and to find the taxonomy of stock markets forecasting tools. The researcher also made an investigation to find out the achievements of the different researches done in the past by the various researchers. Researcher also tried to emphasize on the theory of Efficient Market Hypothesis (EMH). The performance of the different companies was analyzed on the basis of the data which was of one year. Various techniques such as: ‘Support Vector Regression (SVR)’, ‘Support Vector Machine (SVM)’, ‘Decision Trees’, ‘Statistical and Pattern Recognition approaches’ and ‘Machine Learning approaches’ were considered by the researcher in this study. The researcher has concluded that the use of some mathematical techniques can be used to increase the prognostic capability of techniques of technical analysis.

Aguirre, Medina & Mendez (2020) has made an investigation in the existing literature and claimed that there was every possibility that genetic models can generate the better returns over the normal buy and hold strategy. The paper has also made a comparison of returns as generated by genetic algorithm with the traditional techniques of technical analysis. In this paper the researcher has used the methodology in two parts i.e., in the first stage the simple rule of MACD was applied

on data and then in the second stage the genetic algorithm was used to the historical data set as generated from the stage one. Python software was used to generate the genetic algorithm. The researcher also tried to discover out the role of a successful model over the technical analysis and also on the buy and hold strategy. The Genetic Algorithms is applied to NASDAQ stock index and the validity is tested. The researcher was of the view that genetic algorithm can be used as a very important tool for predicting the financial assets. The prediction is very much based on the authenticated historical information.

Kulshrestha, Srivastava & Singh (2020) has made a study on the daily prices of Nifty and Bank Nifty by using three important techniques. The techniques used in case of analysis are exponential Moving Average cross over along with Ami broker software and AFL Language. The result shows that EMA found to be the most important and useful technique in case of predicting the markets and in more than 43% cases where we have taken the decision on the basis of EMA have given the better return over the index return. The researcher further conclude that the technique can be used at more indexes also.

Li, Wu & Wang (2020) investigated on the use of techniques of technical analysis as well as on the information of news as the sentiment analysis. As per the researcher the use of both technical analysis and sentiment analysis has not been earlier very frequently. The researcher has used a new model by using the technique of neural network which will consider both technical analysis and sentiment analysis and then tries to find out the important signal and predicting capability of the model for the market under consideration. The data was taken for Hong Kong stock market and data was taken for more than five years. The model developed by the researcher was named as LSTM and has concluded that using the model with incorporation of both, i.e., techniques of technical analysis and news sentiments can outperform the single model return over the given set of data on the selected market.

Pramudya & Ich Sani (2020) have made an investigation in this research to find the accuracy of techniques of technical analysis in giving proper buy and sell signal for the market under consideration. They have made an investigation in the prices of LQ45 Index by using the three most important techniques of technical analysis. The

techniques which were considered in this research includes, 'Bollinger Bands', 'Moving Average Convergence and Divergence (MACD)' and 'Relative Strength Index (RSI)'. The study is mainly aimed to find out whether these techniques can give an indication regarding the timings of buying and selling of shares in stock market. The researcher used the data for LQ45 Index. The researcher has used the graphical techniques to find out the predicting capability of the techniques used in the study. The researcher in the conclusion found that sell signal can be taken well by the Bollinger bands and MACD as compared to RSI, whereas the buy signal can be well captured by RSI and Bollinger bands as compared to MACD. So, at last the researcher was of the view that one should not rely on one technique of technical analysis whereas he should use a series of techniques for making the prediction of stock market.

Sulistiawan, Rudiawarni & Feliana (2020) have made a study on the Indonesian Stock market after taking the data from 2008 to 2017. The researchers have used the exponential moving average technique for different periods. EMA was taken from a very short period of 5 days to 100 days with a gap of 5 days in each used technique. The researcher when analyzed the data found that as soon as the EMA period go up or with longer EMA one can generate better return as compared to the shorter EMA period. So, in conclusion the researcher explained that the researcher should go with longer EMA than Shorter EMA.

Sagala, Saputri, Mahendra & Budi (2020) has made a study by using some important techniques of sentiment and technical analysis. Techniques used in this paper were algorithms like 'Support vector machine (SVM)', 'K-Nearest Neighbour (KNN)' and 'Naïve Byes'. In order to retrieve hyperlinks web crawling was used which was related and started with the incline of initial URLs. It was concluded in the study that a great level of accuracy can be found in after using the various combinations of technical analysis features with online available media and sentiment label.

Wollian Li A. & Bastos G. (2020) has made a systematic review of literature on the various research papers which have used learning models for predicting the stock markets. It has been analyzed by the researcher that most of researcher were using

learning models in his research. The researchers focused only on those papers which have used the learning models for predicting the stock markets. The researcher found that in 73.5% of the researches LSTM model have been used. A total of 34 articles were considered and it has been found that only 35.3% articles have shown the greater profitability over buy and hold strategy or over other parameters decided by respective researchers. The researcher has concluded that there was still a great area of improvement in the research for this area.

Barroso, Cardoso & Melo (2021) in his study has made a detailed investigation in the Brazilian stock exchange. Data was taken for the study of six years and then the techniques of both technical analysis and multi objective portfolio optimization was used. In this paper the researcher has used the techniques in two ways which includes the researcher uses the first way as generating optimum investment portfolio and then uses the techniques of technical analysis to carry out the various transaction during the month and in second way the researcher uses the optimization on monthly basis. The study concluded that fusions of these two techniques can improve the performance of the portfolio and can provide best strategies to the investor by giving a higher return at a particular level of risk at the realistic constraints.

Daniswara, Widjanarko & Hikmah (2022) in this study the researcher aims to investigate and deliver empirical indication of the accuracy of the technical analysis indicators Moving Average, Bollinger Bands, and Relative Strength Index in forecasting the direction of stock price movements. The focus of the research is on the stock market of Indonesia. The data of LQ45 was collected from February 2021- July 2021. The source of the data was tradingview.com platform. Mann-Whitney non-parametric test was used to test the statistical difference between the standard and actual movement of stock prices. The result concluded that there was no difference between the standard price and actual price meaning thereby that all the three indicators are correct. After making comparison of the result of these three indicators with the number of signals, the sample observation and the average rate of return it is concluded that Relative Strength Index is better than other two indicators.

Kasera A. (2023) in this study the researcher used two techniques of technical analysis to determine the future prices. These two techniques are Moving Average

Convergence Divergence and Relative Strength Index. These two techniques are used on the NSE in India. The main aim of the study is to identify whether technical analysis is better than Buy and hold strategy or not. Data was analysed with the help of mathematical calculation in Excel. It was concluded that indicators of technical analysis proved more profitable than benchmark index.

CHAPTER- 3

RESEARCH METHODOLOGY

In any research work the most important chapter is Research Methodology. With the help of Research Methodology, it is easy to find the solution of the research problem as it is a scientific way to study the research scientifically. Most importantly it consists of all steps that a researcher adopted for the study of a research problem. In any research, a researcher generally considers an arrangement of procedures, models and techniques in order to get the solution of research problem known as research methodology.

“Through the use of methods and techniques that are scientifically defensible, we may come to conclusions that have a high probability of being justifiable in a court of law if so needed.”

Chapter third is divided in three parts. First part is related with need of the study, scope, markets selected for present study and objectives. Second Part deals with the content related to sampling design, research design, collection of data, time period of the study, and chapter scheme required for the study. Part three give details about hypothesis, statistical tools. This part also describes the limitations of the study.

PART-I

3.1 Need of the present study

Right from the inception of civilization, it has been a matter of great concern & controversy as far as the ideal valuation is concerned. In stock market, every stock holder is familiar with the phenomena of increase in the number of analysts and various improvements in analytical techniques. In the recent past, it is observed that professionals are looking for new ways to improve the investment performance and it is not surprising that many analysts have turned their attention to technical analysis. With this ever-increasing importance to the techniques of technical analysis the academicians also try to find out the most profitable techniques with the greater probability of giving good returns. After studying the review of literature and having consultation with the expert in the area it had been found that a very less work has been done on BRICS markets taken together and that's why the study is chosen. The

study is going to use some of the most famous techniques of technical analysis which includes, ‘Exponential Moving Average (EMA)’ and ‘Relative Strength Index (RSI)’. The present study is to investigate whether the alpha returns can be achieved in the BRICS after using the techniques under study. After reviewing the literature, we have found that most of the work related to the technical analysis is not done in India. There is also no study is found that has been conducted on BRICS nation. So, the study may probably be the first, to make an analysis in the BRICS nation. The studies conducted are only limited to find out the predicting ability of technical analysis and none has found out the excess returns generated by the technique of technical analysis. This may probably be the first attempt to find out the excess return i.e., alpha return.

3.2 Scope/area of the study

There are many stock markets in the world. It is really a very tough task to choose all the markets of the world. So, in order to conduct the study, the researcher has taken one of the most talked association of countries which is BRICS i.e., Brazil, Russia, India, China and South Africa. The study will focus on analyzing the markets by using the techniques of technical markets on the index values of the respective countries.

3.3 Profile of the markets & indices

Five markets known as BRICS is selected by the researcher. The study period comprises the data from April 1st, 2008 to December 31st, 2020). The researcher takes into consideration these five markets and the study is conducted from the perspective of Indian Investor.

Table 3.1: Countries with their respective indexes

Country	Index
Brazil	IBOVESPA Index
Russia	RTSI
India	S&P CNX Nifty
China	Shanghai Composite Index
South Africa	FTSE

3.3.1 Bm&f Bovespa (IBOVESPA) (Brazil)

The BM&F BOVESPA is a stock exchange located at São Paulo, Brazil. As on December 31st, 2011, the market capitalization of US was \$1.22 Trillion which made it 13th largest stock in the world. On May 8th, 2008, BM&FBOVESPA was created with the merge of the São Paulo Stock Exchange (Bo vespa) and the Brazilian Mercantile and Futures Exchange (BM&F). The benchmark indicator of BM&FBOVESPA is the Indices Bo vespa. 381 companies were traded at Bo vespa as on April 30th, 2008. On May 20th, 2008 the Ibovespa index reached its 10th consecutive record mark closing at 73,516 points, with a traded volume of USD 4.2 billion or R\$ 7.4 billion, and in August 17, 2011 the Ibovespa made its biggest traded volume in its history, with a volume of USD 14.8 billion or R\$ 23.7 billion.

3.3.2 Russian trading system (RTS) (Russia)

The Russian Trading System (RTS) was a stock market which was established in 1995 in Moscow, combining various regional trading floors into one exchange. Initially RTS was modeled on NASDAQ's trading and settlement software; in 1998 the exchange went on line with its own in-house system. Firstly, it was created as a non-profit organization but later transformed into a joint-stock company. The RTS Stock Exchange counted and published 9 indexes: RTS Index, RTS-2 Index, and 7 Sectoral Indexes. The RTS Index and the RTS-2 Index were calculated using two different lists of stocks. RTS Index, RTSI, the official Exchange indicator, first calculated on September 1st, 1995, was similar in function to the Dow Jones Average in New York City. RTSI was computed on thirty-minute intervals using real-time prices of the 50 most liquid Russian stocks listed on the Exchange and was relayed to the RTS web site, RTS workstations and news agencies. The constituent list of stocks is reviewed every 3 months. RTS-2 Index calculated based on the list of 69 second-tier stocks. The performance over the decade 1998 till 2008 of the RTS Index has been the highest in the world after adjusting for currency effects.

3.3.3 S&P CNX nifty (NIFTY) (India)

For Indian Equity Market, CNX Nifty, also called the Nifty 50 or simply the Nifty, is a National Stock Exchange and the benchmark index of India. Nifty was owned and managed by India Index Services and Products Ltd. (IISL), that was

wholly owned subsidiary of the NSE Strategic Investment Corporation Limited. India's first specialized company was IISL which focused the index as a core product. IISL had a marketing and licensing agreement with Standard & Poor's for co-branding equity indices. 'CNX' in its name stands for 'CRISIL NSE Index'. CNX Nifty was modeled as a largest single financial product in India, with an ecosystem comprising: exchange traded funds (onshore and offshore), exchange-traded futures and options (at NSE in India and at SGX and CME abroad), other index funds and OTC derivatives (mostly offshore). CNX Nifty covers 22 sectors of the Indian economy and offers investment managers exposure to the Indian market in one portfolio. Nifty 50 is a free float market capitalization weighted index. Initially the index was calculated on full market capitalization methodology. From June 26th, 2009, the computation was changed to free float methodology. The base period for the CNX Nifty index was November 3rd, 1995, which marked the completion of one year of operations of National Stock Exchange Market Segment. The base value of the index has been set at 1000, and a base capital of Rs 2.06 trillion.

3.3.4 Shanghai Stock Exchange (SSE) (China)

Shanghai Stock Exchange (SSE) (Chinese: 上海证券交易所), is a stock exchange that is based in the city of Shanghai, China. It is one of the two stock exchanges operating independently in the People's Republic of China, the other is the Shenzhen Stock Exchange. Shanghai Stock Exchange is the world's 6th largest stock market by market capitalization at US\$2.3 trillion as on December, 2011. Unlike the Hong Kong Stock Exchange, the Shanghai Stock Exchange is still not entirely open to foreign investors due to tight capital account controls exercised by the Chinese mainland authorities. The current exchange was re-established on November 26th, 1990 and was in operation on December 19th of the same year. It is a non-profit organization directly administered by the China Securities Regulatory Commission (CSRC).

3.3.5 FTSE/JSE Limited (JSE) (South Africa)

The FTSE/JSE All-Share Index represents 99% of the full market capital value (before the application of any investable weighting) of all ordinary securities listed on the main board of the JSE, subject to minimum free float and liquidity criteria JSE

Limited (previously the JSE Securities Exchange and the Johannesburg Stock Exchange) is the largest stock exchange in Africa. It is located in Sandton, Johannesburg, South Africa, after it moved from downtown Johannesburg in 2000. In 2003 the JSE had an estimated 473 listed companies and a market capitalization of US\$182.6 billion (€158 billion), as well as an average monthly traded value of US\$6.399 billion (€5.5 billion). As of August 2020, the market capitalization of the JSE was at US\$1,005 billion.

3.3.6 Alpha Return

Alpha return can be defined as the excess return generated by a specific market over the return generated by that market using a passive strategy. Here passive strategy means buy and hold strategy and alpha return will be the difference of returns generated using Exponential Moving Average (EMA) and Relative Strength Index (RSI) with this passive strategy. $\text{Alpha Returns} = \text{Net Returns} - \text{Index Return}$.

3.4 Objectives of the study

1. To study the effectiveness of Exponential Moving Average (EMA) for predicting the equity indices of BRICS.
2. To examine the efficiency of Exponential Moving Average (EMA) in generating alpha returns.
3. To study the effectiveness of Relative Strength Index (RSI) in equity indices of BRICS.
4. To evaluate comparative analysis of Alpha returns on BRICS.

PART – II

3.5 Research design

Sequencing of circumstances related with data collection and analysis is termed as research design. The main aim of such an arrangement is to relate the significance of research motive with an economy in procedure. The present study is both empirical and analytical in nature. Theories of technical analysis is verified with the help of observations. So, it is empirical in nature. It has probed the expediency of

indexes with the use of CAGR, Correlation, Alpha ratio, Sharpe ratio and Brock t-statistics. So, it is analytical in nature.

3.5.1 Sampling design (Population, Sample size and Sampling technique)

All stock exchanges which are operating in the world are the population/universe. In this study, the researcher has used BRICS markets for finding out the efficiency and effectiveness of Exponential Moving Average (EMA) and Relative Strength Index (RSI) on the top most indexes of different markets selected for the study.

3.5.2 Nature, Sources and Collection of data

In the present study, only secondary data is used. Secondary data is collected from the website www.finance.yahoo.com as on 19th October, 2020. The date is important to mention as the data tend to change from one date to another date by the data provider.

3.5.3 Time period of the study

Time period of twelve years from April 1st, 2008 to March 31st, 2020 is taken to carry out the present study. As in case of technical analysis it is very difficult to analyze such long data. Thus, the data have been broken in three sub-periods of 4 years each i.e. (2008-2012), (2012-2016), (2016-2020). The researcher has collected the data for all the markets for the complete time period of the study.

3.6 Chapter wise scheme of the study

This research work is classified into five chapters. These are:

1. First chapter describes the concepts related to the fundamental analysis, technical analysis, its assumptions, its characteristics, efficient market hypothesis (EMH), behavioral finance & various techniques of technical analysis.
2. Second chapter is related with literature review and justification of the study.
3. Third chapter is related with methodology used by the researcher for the study. In this chapter all the details related to methodology such as sample size, data, research objectives and other relevant details are explained.

4. Data have been analyzed on selected techniques used in the study.
5. Fifth chapter is comprising of suggestions on the basis of the findings of the study. In this chapter results and findings have been put at one place after using all the analytical tools.

PART – III

3.7 Hypothesis

The following hypothesis were framed in order to attain the objectives in an effective manner: -

H₁: In any of the chosen markets, the return from the active strategy employing the EMA 5-20 is either lower than or equal to the return from the passive approach.

H₂: In any of the chosen markets, the return from the active strategy employing the EMA 5-50 is either lower than or equal to the return from the passive approach.

H₃: In any of the chosen markets, the return from the active strategy employing the EMA 5-100 is either lower than or equal to the return from the passive approach.

H₄: In any of the chosen markets, the return from the active strategy employing the EMA 5-200 is either lower than or equal to the return from the passive approach.

H₅: The return of active strategy using RSI is either less than or equal to the return given by the passive strategy in any of the selected markets.

H₆: There is no significant difference in the Alpha Returns among BRICS. The following sub null hypothesis are created:-

H₀₁:- There is no significant difference in Alpha returns on the basis of technique used by the technical analysis.

H₀₂:- There is no significant difference in Alpha returns in different markets by the using technical analysis.

H₀₃:- There is no significant difference in Alpha returns among blocks using a specific technique of Technical analysis.

3.8 Statistical techniques/tools used

For analyzing the data, several simple statistical techniques like ‘Average’, ‘Standard Deviation’, ‘Compound Annual Average Growth Rate’ and ‘Brock t-test’ are used on the collected data. The statistical tools of technical analysis i.e. Exponential moving average & Relative strength index are used. To measure the efficiency of the particular markets, Sharpe and Alpha ratios are also used.

3.8.1 Exponential Moving Average (EMA)

These are most common and frequently used by trend followers due to ease of computation and effective implementation, however in spite of using Simple Moving Average (SMA), Exponential Moving Average (EMA) has been used in the study that tends to be more sensitive and turns faster than SMA due to higher weight-age to current prices being the stock price behavior parlance is dominated by short term memory. The calculation of n-day Simple Moving Average is: -

$$SMA = \frac{1}{n} \sum_{i=t-n+1}^t C_i$$

$$=(C_t + C_{t-1} + \dots + C_{t-n+2} + C_{t-n+1})/n$$

EMA is very much like Simple Moving Average except inclusion of multiplier (called exponent) that depends upon the number of days chosen for EMA which in our case is 5, 20, 50, 100 and 200-days. Mathematical equations of EMA are

Multiplier can be calculated (e.g., for 5-day EMA) as per the given formula:

$$5 - day\ multiplier = \frac{2}{[1 + number\ of\ day(5)]} = 33.33\%$$

Similarly, it can be reciprocated for 20, 50, 100 and 200-days Multiplier. Next step is to calculate EMA as:

$$EMA_t = [(P_t - EMA_{t-1}) * multiplier] + EMA_{t-1}$$

Where P_t is closing price of the index at time t and EMA_{t-1} is exponential moving average time $t-1$ and multiplier is same as calculated above.

For initial EMA n-day simple moving average is used. In order to generate buy (sell) signals dual EMA is computed, tend to vary from investor to investor, wherein if short-run moving average crosses (from below) the long-run moving average [S_t (n) > L_t (m)] buy signal is generated and vice-versa. Dual strategy followed in the study is [(5, 20), (5, 50), (5,200)] to help investors having both short-run and long-run view on the market, to suit the risk-return profile of varied investors.

To generate buy (sell) signal the short- term EMA (EMAS) should cross the long-term EMA (EMAL) from below (above). Hence, we have used long-short strategy emerging of 5/20 (five-day EMA i.e., latest closing price vis-à-vis twenty-day EMA) and similar in case of 5/50, 5/100 and 5/200.

3.8.2 Relative Strength Index (RSI)

RSI is a technical momentum indicator that compares the magnitude of recent gains to recent losses to determine overbought and oversold situations of an asset. With moving averages, RSI also catch the attention of day trader and probably the most popular oscillator to gage the strength of security prices by measuring ratio of average of upward movement with average of downward movement over a specific rolling period, default period is 14 days. The equation of RSI has been exhibited as: -

$$RSI = 100 - 100 / (1 + RS^*)$$

*Where RS = Average of x days' up closes / Average of x days' down closes.

Upward and downward movement can be defined as:

$$U_i(\text{upward movement}) = \begin{cases} C_i - C_{i-1} & \text{if } C_i > C_{i-1} \\ 0 & \text{otherwise} \end{cases}$$

$$D_i(\text{downward movement}) = \begin{cases} C_{i-1} - C_i & \text{if } C_{i-1} > C_i \\ 0 & \text{otherwise} \end{cases}$$

Relative Strength (RS) is given as:

$$RS_{t,p} = \frac{\overline{U_{t,p}}(\text{Average of } U_i)}{\overline{D_{t,p}}(\text{Average of } D_i)}$$

Where, p is the rolling period. RSI ranges from 0 to 100, wherein 100 imply pure upward price movements (Overbought Market) and 0 implies pure downward price movements (Oversold market). The RSI at time t for period p :

$$RSI_{t,p} = 100 - \frac{100}{1 + RS_{t,p}}$$

RSI is used in various forms such as “Touch”, “Peak”, “Crossover” and “Retracement”, a crossover of 50 has been used in the study e.g., RSI crossing 50 from below (above) will generate buy (sell) signal. The role of volume can't be denied in the world of investment; for a layman it ensures him about the strength of direction in which market is moving on.

3.9 Limitations of the study

The present research work has following shortcomings/limitations:

1. The researcher has taken only the data for 12 years which is due to the time constraints.
2. Many of the techniques of technical analysis are not considered.
3. Though, the researcher has taken a complete of BRICS countries but the research can be extended to many more countries.
4. It is also not possible to consider the all markets of the world because of many reasons like the numbers of markets, availability of the data, trade volume of a particular market and many more. That is why the present study is limited to a group of markets known as BRICS for the application of technical tools.

3.10 Format of writing Bibliography

Generally, in the area of research, two main styles of bibliography viz. American Psychological Association (APA) and Modern Language Association (MLA) are used. In the present study, American Psychological Association (APA) style is used for writing bibliography.

CHAPTER 4

ANALYSIS AND INTERPRETATION

The analysis of any research work is the most important chapter. The chapter focuses on analyzing the various data collected for the research work. In this research, five techniques of technical analysis are considered for analyzing the predictive power of technical analysis on the data set of five markets taken for the study. The markets taken for the study includes Brazilian market, Russian market, Indian market, Chinese market and South African market. The data set is taken for twelve years starting from 1st April, 2008 and ending on 31st March, 2020. The five techniques used in the study includes “Exponential Moving Average 5-20 (EMA 5-20), Exponential Moving Average 5-50 (EMA 5-50), Exponential Moving Average 5-100 (EMA 5-100), Exponential Moving Average 5-200 (EMA 5-200) and Relative Strength Index (RSI).” The data is analyzed by dividing the whole data into three panels of four years each and one panel for the whole aggregate data of 12 years.

To achieve the objectives of research, complete analysis is classified into four sections, which are as follows: -

Part I: - In this part the descriptive analysis of data is done.

Part II: - In this part the effectiveness of all the techniques taken in the study is analyzed.

Part III: - In this part the efficiency of all the techniques in the study is analyzed.

Part IV: - In this part ALPHA returns generated by the techniques are analyzed.

Part I: - In this part the Descriptive Analysis of data is done

Table 4.1 “Descriptive Statistics for all markets”

“Whole Sample Period i.e., from 1st April 2008 to 31st March 2020”

	Brazil	Russia	India	China	South Africa
Mean	0.00007	-0.00025	0.00018863	-0.00008	0.000123
Median	0.000262	0.000529	0.000461102	0.000554	0
Standard Deviation	0.017993	0.021942	0.013559875	0.015676	0.012352
Sample Variance	0.000324	0.000481	0.00018387	0.000246	0.000153
Kurtosis	11.05773	12.2853	17.02451116	5.046883	6.296507
Skewness	-0.46022	-0.491	-0.282900108	-0.57701	-0.51709
Range	0.29672	0.414033	0.302380693	0.179072	0.164146
Minimum	-0.15994	-0.21199	-0.139037542	-0.08873	-0.09475
Maximum	0.136782	0.202039	0.163343151	0.090343	0.069399
Count	2996	3011	2964	2920	3087

Table 4.1 presents a summary of descriptive statistics of returns series for the entire period for all the five markets. Descriptive statistics of returns include “Mean, Median, Minimum, Maximum, Range, Standard Deviation, Sample Variance, Skewness, Kurtosis and Total Number of Counts.”

The mean returns for the whole period are reported positive for 3 out of 5 markets. The mean return is found highest in case of Indian market followed by South African market and then by Brazilian Market. The negative return is shown by Russian market and then by Chinese Market. The maximum standard deviation in daily returns is found in Russia and lowest in South Africa. When checked for the kurtosis value, it has been found that all the markets have leptokurtic distribution and the maximum value of kurtosis is found in case of Indian market. As the normal value of kurtosis is equal to 3 in the series tail shows the standard normal distribution. All the markets have kurtosis value greater than three and this shows that they have a heavier tail than the standard normal distribution. All the returns series accounted for negative skewness. It means there are elements of persistency in the returns. The maximum

number of counts is found in case of South African market and lowest in case of Chinese market.

Table 4.2 Descriptive Statistics for all markets
“Sub Sample Period i.e. from 1st April 2008 to 31st March 2012”

	Brazil	Russia	India	China	South Africa
Mean	0.00006	-0.00023	0.000113	-0.00044	0.00019
Median	0.000808	0.001375	0.000241	0.000451	0.000184
Standard Deviation	0.021163	0.028474	0.018357	0.018672	0.013732
Sample Variance	0.000448	0.000811	0.000337	0.000349	0.000189
Kurtosis	6.877384	9.100309	9.548465	2.765829	2.820501
Skewness	0.0654	-0.32713	0.313709	-0.09472	-0.05747
Range	0.257743	0.414033	0.293485	0.170779	0.134002
Minimum	-0.12096	-0.21199	-0.13014	-0.08044	-0.0773
Maximum	0.136782	0.202039	0.163343	0.090343	0.056705
Count	993	999	990	975	1020

Table 4.2 presents a summary of descriptive statistics of returns series first sub period from 1st April 2008 to 31st March 2012 for all the five markets. Descriptive statistics of returns include “Mean, Median, Minimum, Maximum, Range, Standard Deviation, Sample Variance, Skewness, Kurtosis and Total Number of Counts.”

The mean returns for whole period are reported positive for 3 markets out of 5 markets. The mean return is found highest in case of South African market followed by Indian market and then by Brazilian Market. The negative return is shown by Russian market and then by Chinese Market. The maximum standard deviation in daily returns is found in Russian stock exchange and lowest in South African stock exchange. When checked for kurtosis value, it has been found that three markets i.e., Brazilian, Indian and Russian markets have leptokurtic distribution and the maximum value of kurtosis is found in case of Indian market. As the normal value of kurtosis is equal to 3 in the series tail shows the standard normal distribution. Three markets

have kurtosis value greater than three and this shows that they have a heavier tail than the standard normal distribution whereas two markets i.e., Chinese and South African market has kurtosis value less than three then we can say that the distribution is Platykurtic in nature. The skewness in case of Russian and Chinese market is found to be negative and positive for all other three markets in this sub period. So, the market shows the mixed results. The maximum number of counts is found in case of South African market and lowest in case of Chinese market.

Table 4.3 Descriptive Statistics for all markets
“Sub Sample Period i.e. from 1st April 2012 to 31st March 2016”

	Brazil	Russia	India	China	South Africa
Mean	-0.00025	-0.00062	0.000384	0.000291	0.000439
Median	-0.00051	-0.00089	0.000462	0.000705	0.000332
Standard Deviation	0.01479	0.019875	0.009896	0.016616	0.010442
Sample Variance	0.000219	0.000395	0.00010	0.000276	0.000109
Kurtosis	0.855766	6.916864	2.467372	5.457023	1.992899
Skewness	0.256556	-0.0662	-0.32765	-1.08908	-0.12228
Range	0.11375	0.265007	0.098352	0.144765	0.096871
Minimum	-0.04988	-0.13255	-0.06097	-0.08873	-0.0415
Maximum	0.063874	0.132462	0.03738	0.056036	0.055367
Count	1015	1005	989	972	1035

Table 4.3 presents a summary of descriptive statistics of returns series second sub period from 1st April 2012 to 31st March 2016 for all the 5 markets. Descriptive statistics of returns include “Mean, Median, Minimum, Maximum, Range, Standard Deviation, Sample Variance, Skewness, Kurtosis and Total Number of Counts.”

The mean returns for the whole period are reported positive for 3 markets out of 5 markets. The mean return is found highest in case of South African market followed by Indian market and then by Chinese Market. The negative return is shown by Russian market and then by Brazilian Market. The maximum standard deviation in daily returns is found in Russian stock exchange and lowest in Indian stock exchange. When checked for kurtosis value, it has been found that two markets i.e., Russian and

Chinese markets have leptokurtic distribution and the maximum value of kurtosis is found in case of Russian market. As the normal value of kurtosis is equal to 3 in the series tail shows the standard normal distribution. Three markets have kurtosis value greater than three and this shows that they have a heavier tail than the standard normal distribution whereas three markets i.e., Brazilian, Indian and South African market has kurtosis value less than three and so it means they have less than the standard normal distribution or we can say that the distribution is Platykurtic in nature. The skewness in case of four markets i.e., Russian, Indian, Chinese and South African market is found to be negative and positive for Brazilian market in this sub period. So, the market shows the mixed results. The maximum number of counts is found in case of South African market and lowest in case of Chinese market.

Table 4.4 Descriptive Statistics for all markets
“Sub Sample Period i.e. from 1st April 2016 to 31st March 2020”

	Brazil	Russia	India	China	South Africa
Mean	0.000404	0.00009	0.00007	-0.00009	-0.00026
Median	0.001157	0.000792	0.000523	0.000496	0
Standard Deviation	0.017529	0.015546	0.010797	0.010607	0.012677
Sample Variance	0.000307	0.000242	0.000117	0.000113	0.000161
Kurtosis	21.56988	17.7455	38.20257	6.759577	11.78217
Skewness	-1.8016	-1.97047	-2.93723	-0.83993	-1.27146
Range	0.290166	0.227738	0.203183	0.134883	0.164146
Minimum	-0.15994	-0.13949	-0.13904	-0.08039	-0.09475
Maximum	0.130228	0.088251	0.064145	0.054493	0.069399
Count	988	1007	985	973	1032

Table 4.4 presents a summary of descriptive statistics of returns series for third sub period i.e., from 1st April 2016 to 31st March 2020 for all the 5 markets. Descriptive statistics of returns include “Mean, Median, Minimum, Maximum, Range, Standard Deviation, Sample Variance, Skewness, Kurtosis and Total Number of Counts.”

The mean returns for the whole period are reported positive for 3 markets out of 5 markets. The mean return is found highest in case of Brazilian market followed by Russian market and then by Indian Market. The negative return is shown by Chinese market and then by South African Market. The maximum standard deviation in daily returns is found in Brazilian stock exchange and lowest in Chinese stock exchange. When checked for kurtosis value, it has been found that all markets have leptokurtic distribution (when Kurtosis is greater than 3) and the maximum value of kurtosis is found in case of Indian market. As the normal value of kurtosis is equal to 3 in the series tail shows the standard normal distribution. All the markets have kurtosis value greater than three and this shows that they have a heavier tail than the standard normal distribution. All the returns series accounted for negative skewness. It means there are elements of persistency in the returns. The maximum number of counts is found in case of South African market and lowest in case of Chinese market.

Part II: - In this part the effectiveness of all techniques taken in the study is analyzed.

**Table 4.5 “Outcomes for EMA 5 – 20 Technical Trading Rules”
“Panel I: From 1st April 2008 to 31st March 2020”**

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	1578	1418	-0.00004 (-0.18401)	-0.00018 (0.43048)	-0.00010 (-0.42432)
Russia	RTS I	1651	1360	0.00063 (1.31411) *	0.00133 (2.20146) **	0.00094 (2.61766) ***
India	CNX Nifty	1881	1083	0.00035 (1.10092)	0.00009 (0.94813)	0.00026 (0.42612)
China	Shanghai	1387	1533	0.00029 (0.72723)	0.00042 (1.00495)	0.00036 (1.37000) *
South Africa	FTSE	1964	1123	-0.00011 (-0.66225)	-0.00054 (-1.52978)	-0.00027 (-1.45206)

*“The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance”*

Table 4.5 depicts the results of all the five markets for the complete data set. The data is taken for 12 years starting from 1st April, 2008 to 31st March, 2020. From the table

it can be easily cleared that the total number of count for Bovespa is found to be 2996 i.e. 1578 for number of buys and 1418 for number of sells, similarly in case of RTS I the total number of count is found to be 3011 i.e. 1651 for number of buys and 1360 for number of sells, in case of CNX Nifty the total number of counts are found to be 2964 i.e. 1881 for number of buys and 1083 for number of sells, for Shanghai index the total number of count is found to be 2920 i.e. 1387 for number of buys and 1533 for number of sell and for FTSE index the total number of count is found to be 3087 i.e. 1964 for number of buys and 1123 for number of sell. The maximum number of counts is found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for maximum number of days in these twelve years. The presence of EMA 5-20 trading rules was found significant in Russian and Chinese stock exchange. When analyzed the return for Russian market we found that the mean return in case of long strategy using EMA 5-20 is found to be significant at 10% level, in case of short strategy the mean return is found to be significant at 5% level and the aggregate return is found to be significant at 1% level. So, the null hypothesis is rejected that the return of active strategy using EMA 5-20 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian market. Similarly in case of Chinese market the aggregate return is found to be significant at 10% level of significance. So, we also reject the null hypothesis in case of Chinese market that the return of active strategy using EMA 5-20 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Chinese market. The remaining three markets i.e., Brazilian market, Indian Market and South African market does not show any significant return. Hence null hypothesis i.e., the return of active strategy using EMA 5-20 is either less than or equal to the return given by the passive strategy is accepted for all these three markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these three markets and predicting power of EMA 5-20 for this panel is not good.

Table 4.6 “Outcomes for EMA 5-20 Technical Trading Rules”
“Panel II : From 1st April 2008 to 31st March 2012”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	550	443	0.00042 (0.32645)	0.00042 (0.28298)	0.00042 (0.53746)
Russia	RTS I	599	400	0.00145 (1.13805)	0.00273 (1.75749) **	0.00196 (2.12948) **
India	CNX Nifty	530	460	0.00033 (0.21686)	0.00013 (0.01991)	0.00024 (0.29079)
China	Shanghai	419	556	0.00028 (0.65681)	0.00098 (1.42951) *	0.00068 (1.45375) *
South Africa	FTSE	655	365	0.00004 (-0.22303)	0.00047 (0.78342)	-0.00014 (-0.59601)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.6 depicts the results of all five markets for the complete data set. The data is taken for 04 years starting from 1st April, 2008 to 31st March, 2012. From the table it can be easily cleared that the total number of counts for Bovespa is found to be 993 i.e. 550 for number of buys and 443 for number of sells, similarly in case of RTS I the total number of count is found to be 999 i.e. 599 for number of buys and 400 for number of sells, in case of CNX Nifty the total number of counts are found to be 990 i.e. 530 for number of buys and 460 for number of sells, for Shanghai index the total number of count is found to be 975 i.e. 419 for number of buys and 556 for number of sell and for FTSE index the total number of count is found to be 1020 i.e. 655 for number of buys and 365 for number of sell. The maximum number of counts is found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5-20 trading rules was found to be significant in case of

Russian and Chinese market. When analyzed the return for Russian market we found that the mean return in case of short strategy using EMA 5-20 is found to be significant at 5% level, in case of aggregate return it is found to be significant at 5% level. So, the null hypothesis is rejected that the return of active strategy using EMA 5-20 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian market. Similarly in case of Chinese market the aggregate return as well as short strategy return is found to be significant at 10% level of significance. So, we also reject the null hypothesis in case of Chinese market that the return of active strategy using EMA 5-20 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Chinese market. The remaining three markets i.e., Brazilian market, Indian Market and South African market does not show any significant return. Hence null hypothesis i.e., the return of active strategy using EMA 5-20 is either less than or equal to the return given by the passive strategy is accepted for all these three markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these three markets and predicting power of EMA 5-20 for this panel is not good.

Table 4.7 “Outcomes for EMA 5-20 Technical Trading Rules”
“Panel III : From 1st April 2012 to 31st March 2016”

Markets	Indices	No. (Buy)	No. (Sell)	Long(B)	Short(S)	Long-Short (B-S)
Brazil	Bovespa	406	609	0.00017 (0.48495)	-0.00053 (1.02981)	0.00039 (1.04212)
Russia	RTS I	378	627	-0.00015 (0.39756)	0.00091 (1.51479) *	0.00051 (1.15500)
India	CNX Nifty	622	367	0.00035 (-0.07638)	-0.00045 (-0.10838)	0.00005 (-0.69064)
China	Shanghai	494	478	0.00085 (0.54314)	0.00029 (-0.00413)	0.00057 (0.79366)
South Africa	FTSE	731	304	0.00036 (-0.16376)	-0.00064 (-1.58066)	0.00006 (-0.82877)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.7 depicts the results of all the five markets for the complete data set. Four years data is considered starting from 1st April, 2012 to 31st March, 2016. From the table it can be easily cleared that the total number of counts for Bovespa are found to be 1015 i.e. 406 for number of buys and 609 for number of sells, similarly in case of RTS I the total number of count is found to be 1005 i.e. 378 for number of buys and 627 for number of sells, in case of CNX Nifty the total number of counts are found to be 989 i.e. 622 for number of buys and 367 for number of sells, for Shanghai index the total number of count is found to be 972 i.e. 494 for number of buys and 478 for number of sell and for FTSE index the total number of count is found to be 1035 i.e. 731 for number of buys and 304 for number of sell. The maximum number of counts is found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5–20 trading rules are found to be important in case of Russian market. When analyzed the return for Russian market we found that the mean return in case of short strategy using EMA 5-20 is found to be significant at 10% level. So, the null hypothesis is rejected that the return of active strategy using EMA 5–20 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian market for short strategy. The remaining four markets i.e., Brazilian market, Indian Market, Chinese market and South African market does not show any significant return. Hence, null hypothesis i.e. the return of active strategy using EMA 5–20 is either less than or equal to the return given by the passive strategy is accepted for all these four markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these four markets and predicting power of EMA 5-20 for this panel is not good.

Table 4.8 “Outcomes for EMA 5-20 Technical Trading”**“Panel IV : From 1st April 2016 to 31st March 2020”**

Markets	Indices	No. (Buy)	No. (Sell)	Long(B)	Short(S)	Long-Short (B-S)
Brazil	Bovespa	703	285	0.00043 (0.03229)	-0.00034 (0.62777)	0.00021 (-0.19599)
Russia	RTS I	674	333	0.00034 (0.32139)	0.00041 (0.33060)	0.00036 (0.53040)
India	CNX Nifty	729	256	0.00037 (0.56970)	0.00079 (0.94813)	0.00048 (0.95468)
China	Shanghai	474	499	-0.00028 (-0.31630)	-0.00009 (0.00875)	-0.00018 (-0.40391)
South Africa	FTSE	578	454	-0.00088 (-0.93539)	-0.00052 (-0.36771)	-0.00072 (-1.34761)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.8 depicts the results of all five markets for the complete data set. The data is taken for four years starting from 1st April, 2016 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be 988 i.e. 703 for number of buys and 285 for number of sells, similarly in case of RTS I the total number of count is found to be 1007 i.e. 674 for number of buys and 333 for number of sells, in case of CNX Nifty the total number of counts are found to be 985 i.e. 729 for number of buys and 256 for number of sells, for Shanghai index the total number of count is found to be 973 i.e. 474 for number of buys and 499 for number of sell and for FTSE index the total number of count is found to be 1032 i.e. 578 for number of buys and 454 for number of sell. The maximum number of counts is found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5-20 rules for all the five markets i.e., Brazilian market, Russian market, Indian Market, Chinese market and South African market does not

show any significant return. Hence, null hypothesis i.e., the return of active strategy using EMA 5–20 is either less than or equal to the return given by the passive strategy is accepted for all these five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these three markets and predicting power of EMA 5-20 for this panel is not good.

Table 4.9 “Outcomes for EMA 5 – 50 Technical Trading Rules”

“Panel I : From 1st April 2008 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	1773	1223	0.00039 (0.60438)	0.00040 (0.55247)	0.00040 (0.99880)
Russia	RTS I	1651	1360	0.00015 (0.60210)	0.00074 (1.39126) *	0.00042 (1.35994) *
India	CNX Nifty	1981	983	0.00035 (0.40760)	0.00013 (0.10826)	0.00028 (0.46735)
China	Shanghai	1304	1616	0.00009 (0.32859)	0.00022 (0.61510)	0.00017 (0.67813)
South Africa	FTSE	2116	971	-0.00009 (-0.61867)	-0.00059 (-1.57447)	-0.00025 (-1.37027)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.9 depicts the results of all five markets for the complete data set. The data is taken for 12 years starting from 1st April, 2008 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be 2996 i.e. 1773 for number of buys and 1223 for number of sells, similarly in case of RTS I the total number of count is found to be 3011 i.e. 1651 for number of buys and 1360 for number of sells, in case of CNX Nifty the total number of counts are found to be 2964 i.e. 1981 for number of buys and 983 for number of sells, for Shanghai index the total number of count is found to be 2920 i.e. 1304 for number of buys and 1616 for number of sell and for FTSE index the total number of count is found to be 3087 i.e.

2116 for number of buys and 971 for number of sell. The maximum number of counts are found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these twelve years. The presence of EMA 5-50 trading rules was found to be significant in case of Russian market. When analyzed the return for Russian market we found that the mean return in case of short strategy using EMA 5-50 is found to be significant at 10% level and in case of aggregate return, the returns are found to be significant at 10% level. So, the null hypothesis is rejected that the return of active strategy using EMA 5-50 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian market for short as well as for aggregate strategy. The remaining four markets i.e., Brazilian market, Indian Market, Chinese market and South African market does not show any significant return. Hence, null hypothesis i.e., the return of active strategy using EMA 5–50 is either less than or equal to the return given by the passive strategy is accepted for all these four markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these four markets and predicting power of EMA 5–50 for this panel is not good.

Table 4.10 “Outcomes for EMA 5-50 Technical Trading Rules”
“Panel II : From 1st April 2008 to 31st March 2012”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	539	454	0.00064 (0.51516)	0.00064 (0.48268)	0.00064 (0.86181)
Russia	RTS I	606	393	0.00097 (0.81762)	0.00208 (1.35759) *	0.00141 (1.55209) *
India	CNX Nifty	525	465	0.00051 (0.39799)	0.00033 (0.21230)	0.00043 (0.60874)
China	Shanghai	380	595	0.00010 (0.47702)	0.00078 (1.25868)	0.00052 (1.12314)
South Africa	FTSE	708	312	-0.00011 (-0.44267)	-0.00087 (-1.18973)	-0.00034 (-0.99642)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.10 depicts the results of all five markets for the complete data set. The data is taken for four years starting from 1st April, 2008 to 31st March, 2012. From the table it can be easily cleared that the total number of count for Bovespa is found to be 993 i.e. 539 for number of buys and 455 for number of sells, similarly in case of RTS I the total number of count is found to be 999 i.e. 606 for number of buys and 393 for number of sells, in case of CNX Nifty the total number of counts are found to be 990 i.e. 525 for number of buys and 465 for number of sells, for Shanghai index the total number of count is found to be 975 i.e. 380 for number of buys and 595 for number of sell and for FTSE index the total number of count is found to be 1020 i.e. 708 for number of buys and 312 for number of sell. The maximum number of counts are found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5-50 trading rules was found to be significant in case of Russian market. When analyzed the return for Russian market we found that the mean return in case of short strategy using EMA 5–50 is found to be significant at 10% level and in case of aggregate return, the returns are found to be significant at 10% level. So, the null hypothesis is rejected that the return of active strategy using EMA 5–50 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian market for short as well as for aggregate strategy. The remaining four markets i.e., Brazilian market, Indian Market, Chinese market and South African market does not show any significant return. Hence, null hypothesis i.e., the return of active strategy using EMA 5–50 is either less than or equal to the return given by the passive strategy is accepted for all these four markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these four markets and predicting power of EMA 5–50 for this panel is not good.

Table 4.11 “Outcomes for EMA 5–50 Technical Trading Rules”

“Panel III : From 1st April 2012 to 31st March 2016”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	386	629	-0.00062 (-0.42380)	0.00002 (0.35960)	-0.00022 (-0.39215)
Russia	RTS I	325	680	-0.00115 (-0.41419)	0.00037 (1.00687)	-0.00012 (-0.13289)
India	CNX Nifty	669	320	0.00020 (-0.36875)	-0.00077 (-0.60005)	-0.00011 (-1.28797)
China	Shanghai	421	551	0.00058 (0.30024)	-0.00007 (-0.40692)	0.00021 (0.27129)
South Africa	FTSE	793	242	0.00026 (-0.36789)	-0.00103 (-1.97447)	-0.00004 (-1.18582)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.11 depicts the results of all five markets for the complete data set. Four year’s data is considered starting from 1st April, 2012 to 31st March, 2016. From the table it can be easily cleared that the total number of count for Bovespa is found to be 1015 i.e. 386 for number of buys and 629 for number of sells, similarly in case of RTS I the total number of count is found to be 1005 i.e. 325 for number of buys and 680 for number of sells, in case of CNX Nifty the total number of counts are found to be 989 i.e. 669 for number of buys and 320 for number of sells, for Shanghai index the total number of count is found to be 972 i.e. 421 for number of buys and 551 for number of sell and for FTSE index the total number of count is found to be 1035 i.e. 793 for number of buys and 242 for number of sell. The maximum number of counts are found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5-50 trading rules is not found to be significant in any of the five markets. For all five markets i.e., Brazilian market, Russian market, Indian Market, Chinese market and South African market does not show any significant return. Hence null hypothesis i.e., the return of active strategy using EMA 5–50 is either less than or equal to the return given by the passive strategy is accepted for all these five markets. This also supports that the concept of Efficient Market Hypothesis

is applicable in these five markets and predicting power of EMA 5–50 for this panel is not good.

Table 4.12 “Outcomes for EMA 5 – 50 Technical Trading Rules”

“Panel IV : From 1st April 2016 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	848	140	0.00070 (0.36018)	0.00139 (0.61999)	0.00080 (0.59101)
Russia	RTS I	720	287	0.00005 (-0.05532)	-0.00019 (-0.27271)	-0.00002 (-0.18326)
India	CNX Nifty	787	198	0.00037 (0.58187)	0.00113 (1.25610)	0.00052 (1.01360)
China	Shanghai	503	470	-0.00033 (-0.40192)	-0.00016 (-0.11234)	-0.00025 (-0.57581)
South Africa	FTSE	615	417	-0.00053 (-0.41272)	-0.00013 (0.17498)	-0.00037 (-0.44633)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.12 depicts the results of all five markets for the complete data set. The data is taken for four years starting from 1st April, 2016 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be 988 i.e. 848 for number of buys and 140 for number of sells, similarly in case of RTS I the total number of count is found to be 1007 i.e. 720 for number of buys and 287 for number of sells, in case of CNX Nifty the total number of counts are found to be 985 i.e. 787 for number of buys and 198 for number of sells, for Shanghai index the total number of count is found to be 973 i.e. 503 for number of buys and 470 for number of sell and for FTSE index the total number of count is found to be 1032 i.e. 615 for number of buys and 417 for number of sell. The maximum number of counts are found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5-50 trading rules is not found to be significant in any of the five markets. Hence null hypothesis i.e., the return of active strategy using EMA 5-50 is either less than or equal to the return given by the passive strategy is accepted

for all the five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these five markets and the predicting power of EMA 5-50 for this panel is not good.

Table 4.13 “Outcomes for EMA 5-100 Technical Trading Rules”
“Panel I : From 1st April 2008 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	1780	1216	0.00022 (0.28711)	0.00016 (0.14913)	0.00020 (0.42821)
Russia	RTS I	1604	1407	-0.00004 (0.31222)	0.00049 (1.05512)	0.00021 (0.85004)
India	CNX Nifty	2109	855	0.00037 (0.46383)	-0.00003 (0.41433)	0.00025 (0.21281)
China	Shanghai	1286	1634	-0.00020 (-0.22821)	-0.00001 (0.13687)	-0.00010 (-0.22956)
South Africa	FTSE	2244	843	0.00002 (-0.30236)	-0.00040 (-1.08613)	-0.00009 (-0.77163)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.13 depicts the results of all five markets for the complete data set. The data is taken for 12 years starting from 1st April, 2008 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be 2996 i.e. 1780 for number of buys and 1216 for number of sells, similarly in case of RTS I the total number of count is found to be 3011 i.e. 1604 for number of buys and 1407 for number of sells, in case of CNX Nifty the total number of counts are found to be 2964 i.e. 2109 for number of buys and 855 for number of sells, for Shanghai index the total number of count is found to be 2920 i.e. 1286 for number of buys and 1634 for number of sell and for FTSE index the total number of count is found to be 3087 i.e. 2244 for number of buys and 843 for number of sell. The maximum number of counts is found to be for FTSE index i.e in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5–100 trading rules is not found to be significant in any of the five markets. Hence null hypothesis i.e., the return of active strategy using

EMA 5–100 is either less than or equal to the return given by the passive strategy is accepted for all five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these five markets and predicting power of EMA 5–100 for this panel is not good.

Table 4.14 “Outcomes for EMA 5-100 Technical Trading Rules”

“Panel II : From 1st April 2008 to 31st March 2012”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	529	464	0.00025 (0.16527)	0.00016 (0.08477)	0.00020 (0.24791)
Russia	RTS I	587	412	0.00011 (0.22620)	0.00070 (0.55817)	0.00035 (0.50549)
India	CNX Nifty	518	472	0.00069 (0.57514)	0.00033 (0.20873)	0.00052 (0.75649)
China	Shanghai	370	605	0.00002 (0.40479)	0.00072 (1.20128)	0.00046 (1.45326) *
South Africa	FTSE	749	271	0.00036 (0.25932)	0.00028 (0.10110)	0.00034 (0.34453)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.14 depicts the results of all five markets for the complete data set. Four year’s data is considered starting from 1st April, 2008 to 31st March, 2012. From the table it can be easily cleared that the total number of count for Bovespa is found to be 993 i.e. 529 for number of buys and 464 for number of sells, similarly in case of RTS I the total number of count is found to be 999 i.e. 587 for number of buys and 412 for number of sells, in case of CNX Nifty the total number of counts are found to be 990 i.e. 518 for number of buys and 472 for number of sells, for Shanghai index the total number of count is found to be 975 i.e. 370 for number of buys and 605 for number of sell and for FTSE index the total number of count is found to be 1020 i.e. 749 for number of buys and 271 for number of sell. The maximum number of counts is found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5-100 trading rules were found to be significant in case of

Chinese market. When analysed the return for Chinese market we found that the mean return in case of aggregate return strategy using EMA 5-100 is found to be significant at 10% level. So, the null hypothesis is rejected that the return of active strategy using EMA 5–50 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Chinese market for aggregate strategy. The remaining four markets i.e., Brazilian market, Russian market, Indian Market and South African market does not show any significant return. Hence null hypothesis i.e., the return of active strategy using EMA 5–100 is either less than or equal to the return given by the passive strategy is accepted for all these four markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these four markets and predicting power of EMA 5–100 for this panel is not good.

Table 4.15 “Outcomes for EMA 5-100 Technical Trading Rules”

“Panel III : From 1st April 2012 to 31st March 2016”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	343	672	-0.00082 (-0.62082)	-0.00004 (0.28169)	-0.00031 (-0.66047)
Russia	RTS I	237	768	-0.00135 (-0.50850)	0.00040 (1.07028)	-0.00002 (-0.28998)
India	CNX Nifty	751	238	0.00025 (-0.27016)	-0.00117 (-2.17238)	-0.00009 (-1.54033)
China	Shanghai	422	550	0.00002 (-0.28523)	-0.00050 (-0.89664)	-0.00028 (-0.69169)
South Africa	FTSE	904	131	0.00021 (-0.47932)	-0.00201 (-2.53052)	-0.00007 (-1.42684)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.15 depicts the results of all five markets for the complete data set. Four year’s data is considered starting from 1st April, 2012 to 31st March, 2016. From the table it can be easily cleared that the total number of count for Bovespa is found to be 1015 i.e. 343 for number of buys and 672 for number of sells, similarly in case of RTS I the total number of count is found to be 1005 i.e. 237 for number of buys and 768 for

number of sells, in case of CNX Nifty the total number of counts are found to be 989 i.e. 751 for number of buys and 238 for number of sells, for Shanghai index the total number of count is found to be 972 i.e. 422 for number of buys and 550 for number of sell and for FTSE index the total number of count is found to be 1035 i.e. 904 for number of buys and 131 for number of sell. The maximum number of counts are found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. For all five markets i.e., Brazilian market, Russian market, Indian Market, Chinese market and South African market does not show any significant return. Hence, null hypothesis i.e., the return of active strategy using EMA 5–100 is either less than or equal to the return given by the passive strategy is accepted for all these five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these five markets and predicting power of EMA 5-100 for this panel is not good.

Table 4.16 “Outcomes for EMA 5–100 Technical Trading Rules”
“Panel 1V : From 1st April 2016 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	908	80	0.00060 (0.24728)	0.00186 (0.71307)	0.00071 (0.43437)
Russia	RTS I	780	227	0.00024 (0.20923)	0.00044 (0.31056)	0.00029 (0.39425)
India	CNX Nifty	840	145	0.00027 (0.40345)	0.00068 (0.63472)	0.00033 (0.48375)
China	Shanghai	494	479	-0.00055 (-0.78226)	-0.00038 (-0.48836)	-0.00047 (-1.23259)
South Africa	FTSE	591	441	-0.00071 (-0.68516)	-0.00034 (-0.10908)	-0.00055 (-0.92064)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.16 depicts the results of all five markets for the complete data set. The data is taken for four years starting from 1st April, 2016 to 31st March, 2020. From the table it

can be easily cleared that the total number of count for Bovespa is found to be 988 i.e. 908 for number of buys and 80 for number of sells, similarly in case of RTS I the total number of count is found to be 1007 i.e. 780 for number of buys and 227 for number of sells, in case of CNX Nifty the total number of counts are found to be 985 i.e. 840 for number of buys and 145 for number of sells, for Shanghai index the total number of count is found to be 973 i.e. 494 for number of buys and 479 for number of sell and for FTSE index the total number of count is found to be 1032 i.e. 591 for number of buys and 441 for number of sell. The maximum number of counts are found to be for FTSE index i.e., in case of South African market. This shows that South African market has operated for the maximum number of days in these four years. The presence of EMA 5–100 trading rules is not found to be significant in any of the five markets. Hence, null hypothesis i.e., the return of active strategy using EMA 5–100 is either less than or equal to the return given by the passive strategy is accepted for all the five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these five markets and predicting power of EMA 5–100 for this panel is not good.

Table 4.17 “Outcomes for EMA 5–200 Technical Trading Rules”

“Panel I : From 1st April 2008 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	1820	1176	0.00018 (0.21635)	0.00011 (0.07104)	0.00015 (0.30665)
Russia	RTS I	1561	1450	-0.00018 (0.10501)	0.00033 (0.83204)	0.00007 (0.49270)
India	CNX Nifty	2374	590	0.00019 (0.02437)	-0.00015 (-0.55722)	0.00012 (-0.14603)
China	Shanghai	1068	1852	-0.00036 (-0.50411)	-0.00008 (-0.00526)	-0.00018 (-0.59563)
South Africa	FTSE	2387	700	0.00002 (-0.31014)	-0.00048 (-0.68855)	-0.00009 (-0.79465)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.17 depicts the results of all five markets for the complete data set. The data is taken for twelve years starting from 1st April, 2008 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be 2996 i.e. 1820 for number of buys and 1176 for number of sells, similarly in case of RTSI the total number of count is found to be 3011 i.e. 1561 for number of buys and 1450 for number of sells, in case of CNX Nifty the total number of counts are found to be 2964 i.e. 2374 for number of buys and 590 for number of sells, for Shanghai index the total number of count is found to be 2920 i.e. 1068 for number of buys and 1852 for number of sell and for FTSE index the total number of count is found to be 3087 i.e. 2387 for number of buys and 700 for number of sell. The maximum number of counts is found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for the maximum number of days in these twelve years.

These Five Markets i.e., Brazilian, Russian, Indian, Chinese and South African does not show any significant return. Hence, Null Hypothesis i.e., the return of Active Strategy using EMA 5–200 is either less than or equal to the return given by the Passive Strategy is accepted for all these five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these Five Markets and predicting power of EMA 5–200 for this panel is not good.

Table 4.18 “Outcomes for EMA 5–200 Technical Trading Rules”
“Panel II : From 1st April 2008 to 31st March 2012”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	605	388	0.00038 (0.29148)	0.00044 (0.30174)	0.00040 (0.47855)
Russia	RTS I	568	431	0.00014 (0.24790)	0.00072 (0.57417)	0.00039 (0.54391)
India	CNX Nifty	594	396	0.00017 (0.05894)	-0.00003 (-0.13011)	0.00009 (0.02033)
China	Shanghai	238	737	-0.00115 (-0.52938)	0.00021 (0.71082)	-0.00012 (-0.40850)
South Africa	FTSE	749	271	0.00037 (0.27374)	0.00031 (0.12925)	0.00036 (0.37278)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.18 depicts the results of all five markets for the complete data set. Four year's data is considered starting from 1st April, 2008 to 31st March, 2012. From the table it can be easily cleared that the total number of count for Bovespa is found to be **993** i.e. 605 for number of buys and 388 for number of sells, similarly in case of RTSI the total number of count is found to be **999** i.e. 568 for number of buys and 431 for number of sells, in case of CNX Nifty the total number of counts are found to be **990** i.e. 594 for number of buys and 396 for number of sells, for Shanghai index the total number of count is found to be **975** i.e. 238 for number of buys and 737 for number of sell and for FTSE index the total number of count is found to be **1020** i.e. 749 for number of buys and 271 for number of sell. The maximum number of counts are found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for maximum number of days in these four years.

These Five Markets i.e., Brazilian, Russian, Indian, Chinese and South Africa does not show any significant return. Hence, Null Hypothesis i.e., the return of active strategy using EMA 5–200 is either less than or equal to the return given by the Passive Strategy is accepted for all these five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these Five Markets and predicting power of EMA 5–200 for this panel is not good.

Table 4.19 “Outcomes for EMA 5–200 Technical Trading Rules”
“Panel III : From 1st April 2012 to 31st March 2016”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	249	766	-0.00145 (-1.14507)	-0.00014 (0.15621)	-0.00046 (-1.31686)
Russia	RTS I	114	891	-0.00158 (-0.48715)	0.00050 (1.22717)	0.00027 (-0.35606)
India	CNX Nifty	829	160	0.00020 (-0.38549)	-0.00131 (-2.01342)	-0.00004 (-1.46801)
China	Shanghai	359	613	0.00052 (0.22496)	-0.00016 (-0.52248)	0.00009 (0.05843)
South Africa	FTSE	959	76	0.00033 (-0.24124)	-0.00186 (-1.85561)	0.00017 (-0.93273)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.19 depicts the results of all five markets for the complete data set. Four year's data is considered starting from 1st April, 2012 to 31st March, 2016. From the table it can be easily cleared that the total number of count for Bovespa is found to be **1015** i.e. 249 for number of buys and 766 for number of sells, similarly in case of RTSI the total number of count is found to be **1005** i.e. 114 for number of buys and 891 for number of sells, in case of CNX Nifty the total number of counts are found to be **989** i.e. 829 for number of buys and 160 for number of sells, for Shanghai index the total number of count is found to be **972** i.e. 359 for number of buys and 613 for number of sell and for FTSE index the total number of count is found to be **1035** i.e. 959 for number of buys and 76 for number of sell. The maximum number of counts are found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for maximum number of days in these four years.

These Five Markets i.e., Brazilian, Russian, Indian, Chinese and South African does not show any significant return. Hence Null Hypothesis i.e., the return of Active Strategy using EMA 5–200 is either less than or equal to the return given by the Passive Strategy is accepted for all these five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these Five Markets and predicting power of EMA 5–200 for this panel is not good.

Table 4.20 “Outcomes for EMA 5–200 Technical Trading Rules”

“Panel 1V : From 1st April 2016 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	966	22	0.00048 (0.09971)	0.00307 (0.70497)	0.00054 (0.21145)
Russia	RTS I	879	128	-0.00021 (-0.41731)	-0.00215 (-1.53197)	-0.00046 (-1.14483)
India	CNX Nifty	951	34	0.00021 (0.28788)	0.00388 (2.02550)**	0.00033 (0.57810)
China	Shanghai	471	502	-0.00064 (-0.91695)	-0.00042 (-0.56378)	-0.00053 (-1.42491)
South Africa	FTSE	679	353	-0.00081 (-0.86995)	-0.00079 (-0.67349)	-0.00080 (-1.36769)

*The sign * shows significant at 10% level, ** at 5% level and *** at 1% level of significance*

Table 4.20 depicts the results of all five markets for the complete data set. The data is taken for four years starting from 1st April, 2016 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be **988** i.e. 966 for number of buys and 22 for number of sells, similarly in case of RTSI the total number of count is found to be **1007** i.e. 879 for number of buys and 128 for number of sells, in case of CNX Nifty the total number of counts are found to be **985** i.e. 951 for number of buys and 34 for number of sells, for Shanghai index the total number of count is found to be **973** i.e. 471 for number of buys and 502 for number of sell and for FTSE index the total number of count is found to be **1032** i.e. 679 for number of buys and 353 for number of sell . The maximum number of counts are found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for maximum number of days in these four years.

The presence of EMA 5–200 trading rules is found to be significant in case of Indian market. When analyzed the return for Indian market we found that the mean return in case of only Short Strategy using EMA 5–200 is found to be significant at 5% level. So, the null hypothesis is rejected that the return of active strategy using EMA 5–200 is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Indian market.

The remaining four markets i.e., Brazilian, Russian, Chinese and South African does not show any significant return. Hence, Null Hypothesis i.e., the return of active strategy using EMA 5–200 is either less than or equal to the return given by the Passive Strategy is accepted for all these four markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these Four Markets and predicting power of EMA 5–200 for this panel is not good.

Table 4.21 “Outcomes for RSI Technical Trading Rules”

“Panel I : From 1st April 2008 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	1578	1418	-0.00004 (-0.18401)	-0.00018 (-0.43048)	-0.00010 (-0.42432)
Russia	RTS I	1582	1429	0.00062 (1.28568)*	0.00122 (2.09660)**	0.00091 (2.57542)***
India	CNX Nifty	1713	1251	0.00045 (0.64385)	0.00017 (-0.03156)	0.00034 (0.82049)
China	Shanghai	2660	260	-0.00007 (0.03398)	0.00023 (-0.30219)	-0.00004 (0.29761)
South Africa	FTSE	1751	1336	-0.00007 (-0.52593)	-0.00037 (0.608964)	-0.00020 (-1.19581)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.21 depicts the results of all five markets for the complete data set. The data is taken for twelve years starting from 1st April, 2008 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be **2996** i.e. 1578 for number of buys and 1418 for number of sells, similarly in case of RTSI the total number of count is found to be **3011** i.e. 1582 for number of buys and 1429 for number of sells, in case of CNX Nifty the total number of counts are found to be **2964** i.e. 1713 for number of buys and 1251 for number of sells, for Shanghai index the total number of count is found to be **2920** i.e. 2660 for number of buys and 260 for number of sell and for FTSE index the total number of count is found to be **3087** i.e. 1751 for number of buys and 1336 for number of sell . The maximum number of counts is found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for the maximum number of days in these twelve years.

The presence of RSI trading rules was found to be significant in case of Russian market. When analyzed the return for Russian market we found that the mean return in case of Long Strategy using RSI is found to be significant at 10% level, in case of short strategy the mean return is found to significant at 5% level and the aggregate

return is found to be significant at 1% level. So, the null hypothesis is rejected that the return of active strategy using RSI is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian market.

The remaining four markets i.e., Brazilian, Indian, Chinese and South African does not show any significant return. Hence, Null Hypothesis i.e., the return of Active Strategy using RSI is either less than or equal to the return given by the Passive Strategy is accepted for all these four markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these Four Markets and predicting power of RSI for this panel is not good.

Table 4.22 “Outcomes for RSI Technical Trading Rules”
“Panel II : From 1st April 2008 to 31st March 2012”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	545	448	-0.00012 (-0.15539)	-0.00027 (-0.27152)	-0.00019 (-0.31679)
Russia	RTS I	578	421	0.00138 (1.07825)	0.00243 (1.60542)*	0.00182 (2.06261)**
India	CNX Nifty	535	455	0.00063 (0.52760)	0.00050 (0.37012)	0.00057 (0.85102)
China	Shanghai	919	56	0.00046 (-0.02155)	0.00014 (-0.22413)	-0.00042 (0.05391)
South Africa	FTSE	586	434	0.00006 (-0.18050)	-0.00036 (-0.70409)	-0.00012 (-0.53668)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.22 depicts the results of all five markets for the complete data set. The data is taken for four years starting from 1st April, 2008 to 31st March, 2012. From the table it can be easily cleared that the total number of count for Bovespa is found to be **993** i.e. 545 for number of buys and 448 for number of sells, similarly in case of RTSI the total number of count is found to be **999** i.e. 578 for number of buys and 421 for number of sells, in case of CNX Nifty the total number of counts are found to be **990** i.e. 535 for number of buys and 455 for number of sells, for Shanghai index the total

number of count is found to be **975** i.e. 919 for number of buys and 56 for number of sell and for FTSE index the total number of count is found to be **1020** i.e. 586 for number of buys and 434 for number of sell. The maximum number of counts are found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for the maximum number of days in these four years.

The presence of RSI trading rules is found to be significant in case of Russian market. When analyzed the return for Russian market we found that the mean return in case of short strategy is found to be significant at 10% level and the aggregate return is found to be significant at 5% level. So, the null hypothesis is rejected that the return of active strategy using RSI is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian market.

The remaining four markets i.e., Brazilian, Indian, Chinese and South African does not show any significant return. Hence, Null Hypothesis i.e., the return of active strategy using RSI is either less than or equal to the return given by the Passive Strategy is accepted for all these four markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these four markets and predicting power of RSI for this panel is not good.

Table 4.23 “Outcomes for RSI Technical Trading Rules”
“Panel III : From 1st April 2012 to 31st March 2016”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	449	566	-0.00020 (0.05777)	0.00029 (0.69382)	0.00007 (0.36433)
Russia	RTS I	433	572	0.00044 (0.93166)	0.00143 (1.96978) **	0.00100 (2.02576) **
India	CNX Nifty	560	429	0.000472 (0.16889)	-0.000268 (-1.13919)	0.00015 (-0.27400)
China	Shanghai	872	100	0.00045 (0.20291)	0.00108 (-0.45180)	0.00051 (0.91528)
South Africa	FTSE	621	414	0.00016 (-0.53415)	-0.00086 (2.14541) **	-0.00025 (-1.65318)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.23, depicts the results of all five markets for the complete data set. Four years data is considered starting from 1st April, 2012 to 31st March, 2016. From the table it can be easily cleared that the total number of count for Bovespa is found to be **1015** i.e. 449 for number of buys and 566 for number of sells, similarly in case of RTSI the total number of count is found to be **1005** i.e. 433 for number of buys and 572 for number of sells, in case of CNX Nifty the total number of counts are found to be **989** i.e. 560 for number of buys and 429 for number of sells, for Shanghai index the total number of count is found to be **972** i.e. 872 for number of buys and 100 for number of sell and for FTSE index the total number of count is found to be **1035** i.e. 621 for number of buys and 414 for number of sell . The maximum number of counts are found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for the maximum number of days in these four years.

The presence of RSI trading rules is found significant in case of Russian and South African market. When analyzed the return for Russian market we found that the mean return in case of short strategy is found to be significant at 5% level and the aggregate return is found to be significant at 5% level. Similarly in case of South African market only Short Strategy is found to be significant at 5% level. So, the null hypothesis is rejected that the return of active strategy using RSI is either less than or equal to the return given by the passive strategy and we accept the alternative hypothesis that the return given by active strategy is higher than of passive strategy in case of Russian and South African market.

The remaining three markets i.e., Brazilian, Indian and Chinese does not show any significant return. Hence, Null Hypothesis i.e., the return of Active Strategy using RSI is either less than or equal to the return given by the Passive Strategy is accepted for all these three markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these three markets and predicting power of RSI for this panel is not good.

Table 4.24 “Outcomes for RSI Technical Trading Rules”

“Panel IV: From 1st April 2016 to 31st March 2020”

Markets	Indices	No. (Buy)	No. (Sell)	Long (B)	Short (S)	Long-Short (B-S)
Brazil	Bovespa	584	404	0.00017 (-0.25655)	-0.00074 (-1.10909)	-0.00020 (-0.77820)
Russia	RTS I	571	436	0.00000 (-0.11468)	-0.00021 (-0.33081)	-0.00009 (-0.28301)
India	CNX Nifty	618	367	0.00028 (0.38450)	0.00029 (0.33487)	0.00028 (0.59374)
China	Shanghai	869	104	0.00017 (-0.15409)	-0.00055 (-0.41470)	-0.00021 (-0.62338)
South Africa	FTSE	544	488	-0.00047 (-0.31779)	0.00005 (0.44056)	-0.00023 (-0.20682)

*The sign *shows significant at 10% level, **at 5% level and ***at 1% level of significance*

Table 4.24 depicts the results of all five markets for the complete data set. The data is taken for four years starting from 1st April, 2016 to 31st March, 2020. From the table it can be easily cleared that the total number of count for Bovespa is found to be **988** i.e. 584 for number of buys and 404 for number of sells, similarly in case of RTSI the total number of count is found to be **1007** i.e. 571 for number of buys and 436 for number of sells, in case of CNX Nifty the total number of counts are found to be **985** i.e. 618 for number of buys and 367 for number of sells, for Shanghai index the total number of count is found to be **973** i.e. 869 for number of buys and 104 for number of sell and for FTSE index the total number of count is found to be **1032** i.e. 544 for number of buys and 488 for number of sell. The maximum number of counts are found to be for FTSE index i.e. in case of South African market. This shows that South African market has operated for the maximum number of days in these four years.

These Five Markets i.e., Brazilian, Russian, Indian, Chinese and South African does not show any significant return. Hence Null Hypothesis i.e., the return of active strategy using RSI is either less than or equal to the return given by the Passive Strategy is accepted for all these five markets. This also supports that the concept of Efficient Market Hypothesis is applicable in these Five Markets and predicting power of RSI for this panel is not good.

Part III: - In this part the efficiency of all techniques in the study is analyzed

Table-4.25: Risk-Return Analysis of Long-Short Strategy (5–20)

“Panel-I : Whole Sample Period i.e., 01 April 2008 to 31 March 2020”

Market	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ^{4,5} Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	166	18.04	101.11	6.00	3	1.66	99.45	5.92	3	278.46	79.22
Russia	RTS I	156	19.30	284.20	11.87	1	1.60	282.60	11.83	1	1034.24	358.81
India	CNX Nifty	168	17.64	75.54	4.8	4	1.68	73.86	4.72	4	249.34	53.46
China	Shanghai	162	18.02	104.30	6.13	2	1.62	102.68	6.06	2	508.84	126.12
South Africa	FTSE	214	14.42	-82.42	-13.49	5	2.20	-84.62	-14.44	5	-627.36	-122.53

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.25 depicts the results of EMA 5-20 for the whole period i.e., from 1st April 2008 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5–20 and then check the efficiency of EMA 5–20 for the whole period data. When analyzed the number of trades the maximum number of trades are done in case of South African market (214) and the least number of trades are in case of Russian market (156). Trade repetition time was least in case of South African market (14.42 days) and maximum in case of Russian market (19.30 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African exchange. The gross return for the data period was found to be maximum in case of Russian market (284.20%) and least in case of South African market (-82.42%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return was found in case of Russian market (11.87%) and least in case of South African market (-13.49%). That’s why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of trades are maximum in case of South African market that’s why the maximum transaction cost was in case of South African

Market (2.20%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Russian market (282.60%) and CAGR is also maximum in case of Russian market (11.83%). On the basis of CAGR in case of net returns, the first rank is assigned to Russian market for this data period. Alpha return is maximum in case of Russian market i.e., 358.81 % and is negative for South African market i.e., -122.53%. Out of all the five markets taken for the study four markets have shown positive alpha return and only one market i.e., South African market has shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-20 has shown good efficiency for the given data period. The Sharpe ratio is highest i.e., 1034.24 for Russian market and lowest i.e., -627.36 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.26: Risk-Return Analysis of Long-Short Strategy (5–20)

“Panel-II : Sub Sample Period i.e., 01 April 2008 to 31 March 2012”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ^{4,5} Ratio (%)	Alpha ⁶ (Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	56	17.73	41.00	8.97	3	0.56	40.44	8.86	3	122.29	34.79
Russia	RTS I	38	26.29	196.10	31.18	1	.40	195.7	31.13	1	629.35	218.34
India	CNX Nifty	60	16.5	23.50	5.42	4	.60	22.90	5.29	4	54.57	11.70
China	Shanghai	50	19.5	66.05	13.52	2	.50	65.05	13.35	2	441.30	109.38
South Africa	FTSE	60	17	-14.63	-3.88	5	.60	-15.23	-4.05	5	-177.26	-34.62

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.26 depicts the results of EMA 5-20 for sub period i.e., from 1st April 2008 to 31st march 2012 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-20 and then check the efficiency of EMA 5–20 for the sub period data. When analyzed the number of trades the maximum number of trades are done in case of South African and Indian market (60) and the least number of

trades are in case of Russian market (38). Trade repetition time was least in case of Indian market (16.5 days) and maximum in case of Russian market (26.29 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of Indian market for this period. The gross return for the data period is found to be maximum in case of Russian market (196.10%) and least in case of South African stock exchange (-14.63%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return was found in case of Russian market (31.18%) and least in case of South African market (-3.88%) that's why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of trades. As frequency of transactions are maximum in case of South African and Indian market that's why the maximum transaction cost was in case of South African and Indian Market (0.60%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Russian market (195.70%) and CAGR is also maximum in case of Russian market (31.13%). On the basis of CAGR in case of net returns the first rank is assigned to Russian market for this data period. Alpha return is maximum in case of Russian market i.e., 218.34 % and is negative for South African market i.e., -34.62%. Out of all the five markets taken for the study four markets have shown positive alpha return and only one market i.e., South African market has shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-20 has shown good efficiency for the given data period. The Sharpe ratio is highest i.e., 629.35 for Russian market and lowest i.e., -177.26 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.27: Risk-Return Analysis of Long-Short Strategy (5–20)

“Panel-III : Sub Sample Period i.e., 01 April 2012 to 31 March 2016”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ ₅ Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	48	21.15	39.28	8.64	3	0.48	38.80	8.54	3	225.56	64.17
Russia	RTS I	54	18.61	51.54	10.95	2	0.55	50.99	10.85	2	327.27	113.54
India	CNX Nifty	62	15.95	4.97	1.22	5	0.62	4.35	1.07	5	-156.62	-33.58
China	Shanghai	52	18.69	55.83	11.73	1	0.52	55.31	11.63	1	108.86	26.98
South Africa	FTSE	62	16.69	6.67	1.63	4	0.64	6.03	1.47	4	-201.78	-39.41

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.27 depicts the results of EMA 5-20 for sub period i.e., from 1st April 2012 to 31st march 2016 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-20 and then checks the efficiency of EMA 5–20 for the sub period data. When analyzed the number of trades, the maximum number of trades are done in case of South African and Indian market (62) and the least number of trades are in case of Brazilian market (48). Trade repetition time is least in case of Indian market (15.95 days) and maximum in case of Brazilian market (21.15 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of Indian market for this period. The gross return for the data period is found maximum in case of Chinese market (55.83%) and least in case of Indian market (4.97%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return was found in case of Chinese market (11.73%) and least in case of Indian market (1.22%). That’s why the Chinese market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of trades are maximum in case of South African and Indian market that’s why the maximum

transaction cost is in case of South African market (0.64%) and Indian Market (0.60%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Chinese market (55.31%) and CAGR is also maximum in case of Chinese market (11.63%). On the basis of CAGR in case of net returns the first rank is assigned to Chinese market for this data period. Alpha return is maximum in case of Russian market i.e., 113.54 % and is in negative for South African (-39.41%) and Indian market (-33.58%). Out of all the five markets taken for the study three markets have shown positive alpha return and two markets i.e., South African and Indian market has shown negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-20 has shown average efficiency for the given data period. The Sharpe ratio is highest i.e., 327.27 for Russian market and lowest i.e.-201.78 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.28: Risk-Return Analysis of Long-Short Strategy (5–20)

“Panel-IV : Sub Sample Period i.e., 01 April 2016 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	62	15.94	20.83	4.84	3	0.62	20.21	4.71	3	-69.39	-19.74
Russia	RTS I	64	15.73	36.56	8.10	2	0.65	35.91	7.97	2	77.62	26.93
India	CNX Nifty	46	21.41	47.07	10.12	1	0.47	46.60	10.04	1	185.73	39.82
China	Shanghai	60	16.22	-17.59	-4.72	4	0.60	-18.19	-4.90	4	-37.36	-9.26
South Africa	FTSE	92	11.22	-74.45	-28.90	5	0.94	-75.39	-29.57	5	-248.12	-48.46

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.28 depicts the results of EMA 5-20 for sub period i.e., from 1st April 2016 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-20 and then checks the efficiency of EMA 5–20 for the sub period data. When analyzed the number of trades the maximum number of trades

are done in case of South African market (92) and the least number of trades are in case of Indian market (46). Trade repetition time is least in case of South African market (11.22 days) and maximum in case of Indian market (21.41 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market for this period. The gross return for the data period is found to be maximum in case of Indian market (47.07%) and least in case of South African market (-74.45%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Indian market (10.12%) and least in case of South African market (-28.90%) that's why the Indian market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of trades are maximum in case of South African market that's why the maximum transaction cost is in case of South African market (0.94%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Indian market (46.60%) and CAGR is also maximum in case of Indian market (10.04%). On the basis of CAGR in case of net returns the first rank is assigned to Indian market for this data period. Alpha return is maximum in case of Indian market i.e., 39.82 % and is in negative for South African (-48.46%), Brazilian market (-19.74%) and Chinese market (-9.26%). Out of all the five markets taken for the study only two markets have shown positive alpha return and three markets i.e., South African, Brazilian and Chinese market have shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-20 has shown low efficiency for the given data period. The Sharpe ratio is highest i.e.185.73 for Indian market and lowest i.e.-248.12 in case of South African market. When checked for Sharpe ratio, Indian market shows the best performance and the least performed market is South African market.

Table-4.29: Risk-Return Analysis of Long-Short Strategy (5-50)

“Panel - I: Whole Sample Period i.e., 01 April 2008 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe Ratio ^{4,5} (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	104	28.81	119.26	6.76	2	1.04	118.22	6.72	2	344.44	97.99
Russia	RTS I	118	25.52	126.23	7.04	1	1.21	125.02	6.99	1	580.03	201.23
India	CNX Nifty	99	29.94	82.37	5.13	3	0.98	81.39	5.09	3	118.84	25.48
China	Shanghai	114	25.61	47.25	3.28	4	1.14	46.11	3.21	4	280.56	69.54
South Africa	FTSE	142	21.74	-77.22	-11.60	5	1.46	-78.68	-12.08	5	-596.90	-116.58

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.29 depicts the results of EMA 5–50 for the whole period i.e. from 1st April 2008 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-50 and then checks the efficiency of EMA 5–50 for the whole period data. When analyzed the number of trades the maximum number of trades are done in case of South African market (142) and the least number of trades are in case of Indian market (99). Trade repetition time is least in case of South African market (21.74 days) and maximum in case of Indian market (29.94 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market. The gross return for the data period is found to be maximum in case of Russian market (126.23%) and least in case of South African market (-77.22%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Russian market (7.04%) and least in case of South African market (-11.60%) that’s why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of trades. As the frequency of transactions are maximum in case of South African market that’s why the maximum transaction cost is in case of South African Market (1.46%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Russian market (125.02%) and CAGR is also maximum in case

of Russian market (6.99%). On the basis of CAGR in case of net returns the first rank is assigned to Russian market for this data period. Alpha return is maximum in case of Russian market i.e., 201.23 % and is in negative for South African market i.e., -116.58%. Out of all the five markets taken for the study, four markets have shown positive alpha returns and only one market i.e., South African market has shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-20 has shown good efficiency for the given data period. The Sharpe ratio is highest i.e., 580.03 for Russian market and lowest i.e., -596.90 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

**Table-4.30: Risk-Return Analysis of Long-Short Strategy (5-50)
“Panel-II : Sub Sample Period i.e., 01 April 2008 to 31 March 2012”**

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe Ratio ^{4,5} (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	34	29.21	63.36	13.05	2	0.34	63.02	13.00	2	201.66	57.37
Russia	RTS I	30	33.30	140.46	24.53	1	0.32	140.14	24.48	1	469.20	162.78
India	CNX Nifty	34	29.12	42.10	9.18	4	0.34	41.76	9.12	4	142.54	30.56
China	Shanghai	30	32.50	50.38	10.74	3	0.30	50.08	10.68	3	374.85	92.91
South Africa	FTSE	54	18.89	-34.70	-10.11	5	0.54	-35.24	-10.29	5	-279.71	-54.63

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.30 depicts the results of EMA 5-50 for sub period i.e., from 1st April 2008 to 31st march 2012 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-50 and then checks the efficiency of EMA 5–50 for the sub period data. When analyzed the number of trades the maximum number of trades are done in case of South African market (54) and the least number of trades are in case of Russian and Chinese market (30). Trade repetition time is least in case of South African market (18.89 days) and maximum in case of Russian market (33.30 days). The less is trade repetition time, more active one need to be in the market. So,

we can say that an investor needs to be more active in case of South African stock market for this period. The gross return for the data period is found to be maximum in case of Russian market (140.46%) and least in case of South African market (-34.70%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Russian market (24.53%) and least in case of South African market (-10.11%). That's why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of trades. As frequency of transactions are maximum in case of South African market that's why the maximum transaction cost is in case of South African Market (0.54%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Russian market (140.14%) and CAGR is also maximum in case of Russian market (24.48%). On the basis of CAGR in case of net returns the first rank is assigned to Russian market for this data period. Alpha return is maximum in case of Russian market i.e., 162.78 % and is in negative for South African market i.e., -54.63%. Out of all the five markets taken for the study four markets have shown positive alpha return and only one market i.e., South African market has shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-50 has shown good efficiency for the given data period. The Sharpe ratio is highest i.e., 469.20 for Russian market and lowest i.e., -279.71 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.31: Risk-Return Analysis of Long-Short Strategy (5-50)

“Panel-III : Sub Sample Period i.e., 01 April 2012 to 31 March 2016”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe Ratio ^{4,5} (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	46	22.06	-22.86	-6.28	5	0.46	-23.32	-6.42	5	7.31	2.05
Russia	RTS I	44	22.84	-12.05	-3.16	4	0.43	-12.48	-3.28	4	144.32	50.07
India	CNX Nifty	37	26.73	-11.06	-2.89	3	0.36	-11.42	-2.99	3	-230.18	-49.35
China	Shanghai	42	23.14	20.72	4.82	1	0.42	20.30	4.73	1	-32.40	-8.03
South Africa	FTSE	36	28.75	-4.56	-1.16	2	0.36	-4.92	-1.25	2	-257.85	-50.36

¹) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on

average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.31 depicts the results of EMA 5-50 for sub period i.e., from 1st April 2012 to 31st march 2016 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5–50 and then checks the efficiency of EMA 5-50 for the sub period data. When analyzed the number of trades the maximum number of trades are done in case of Brazilian market (46) and the least number of trades are in case of South African market (36). Trade repetition time is least in case of Brazilian market (22.06 days) and maximum in case of South African market (28.75 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of Brazilian market for this period. The gross return for the data period is found to be maximum in case of Chinese market (20.72%) and least in case of Brazilian market (-22.86%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Chinese market (4.82%) and least in case of Brazilian market (-6.28%) that’s why the Chinese market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of transactions are maximum in case of Brazilian market that’s why the maximum transaction cost is in case of Brazilian Market (0.46%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Chinese market (20.30%) and CAGR is also maximum in case of Chinese market (4.73%). On the basis of CAGR in case of net returns the first rank is assigned to Chinese market for this data period. Alpha return is maximum in case of Russian market i.e., 50.07 % and is in negative for South African (-50.36%), Indian (-49.35%) and Chinese market i.e., -08.03%. Out of all the five markets taken for the study only two markets have shown positive alpha returns and three market i.e., South African market, Indian market and Chinese market have shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-50 has shown low efficiency for the given data period. The Sharpe ratio is highest i.e., 144.32 for Russian market and lowest i.e., -257.85 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.32: Risk-Return Analysis of Long-Short Strategy (5-50)

“Panel-IV : Sub Sample Period i.e., 01 April 2016 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio ⁵ (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	24	41.17	78.76	15.63	1	0.24	78.52	15.59	1	135.58	38.57
Russia	RTS I	44	22.89	-2.18	-0.55	3	0.45	-2.73	-0.69	3	-33.76	-11.71
India	CNX Nifty	28	35.18	51.33	10.91	2	0.28	51.05	10.86	2	206.48	44.27
China	Shanghai	42	23.17	-23.86	-6.59	4	0.42	-24.28	-6.72	4	-61.93	-15.35
South Africa	FTSE	52	19.85	-37.95	-11.25	5	0.54	-38.49	-11.44	5	-59.19	-11.56

“1) The amount of trades is determined as follows: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.32 depicts the results of EMA 5-50 for sub period i.e., from 1st April 2016 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-50 and then checks the efficiency of EMA 5–50 for the sub period data. When analyzed the number of trades the maximum number of trades are done in case of South African market (52) and the least number of trades are in case of Brazilian market (24). Trade repetition time is least in case of South African market (19.85 days) and maximum in case of Brazilian stock market (41.17 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market for this period. The gross return for the data period is found to be maximum in case of Brazilian market (78.76%) and least in case of South African market (-37.95%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Brazilian market (15.63%) and least in case of South African market (-11.25%). That’s why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of trades are maximum in case of South African market that’s why the maximum transaction cost is in case of South African Market (0.54%). After adjusting the transaction cost, we reached on the net returns. The maximum net

returns are in case of Brazilian market (78.52%) and CAGR is also maximum in case of Brazilian market (15.59%). On the basis of CAGR in case of net returns the first rank is assigned to Brazilian market for this data period. Alpha return is maximum in case of Indian market i.e., 44.27 % and is in negative for South African market (-11.56%), Russian market (-11.71%) and for Chinese market (-15.35%). Out of all the five markets taken for the study only two markets have shown positive alpha return and only three markets have shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-50 has shown low efficiency for the given data period. The Sharpe ratio is highest i.e., 206.48 for Indian market and lowest i.e., -61.93 in case of Chinese market. When checked for Sharpe ratio, Indian market shows the best performance and the least performed market is Chinese market.

Table-4.33: Risk-Return Analysis of Long-Short Strategy (5-100)

“Panel-I : Whole Sample Period i.e., 01 April 2008 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio (%) ⁵	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	70	42.8	58.84	3.93	3	0.70	58.14	3.89	3	133.26	37.91
Russia	RTS I	86	35.01	62.95	4.15	2	0.91	62.04	4.10	2	398.50	138.25
India	CNX Nifty	72	41.17	75.05	4.78	1	0.73	74.32	4.74	1	85.87	18.41
China	Shanghai	100	29.20	-28.00	-2.70	4	1.00	-29.00	-2.81	4	-22.47	-5.57
South Africa	FTSE	106	29.12	-29.30	-4.07	5	1.10	-30.40	-4.22	5	-349.75	-68.31

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.33 depicts the results of EMA 5-100 for the whole period i.e., from 1st April 2008 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-100 and then checks the efficiency of EMA 5–100 for the whole period data. When analyzed the number of trades the maximum number of trades are done in case of South African market (106) and the least number of trades are in case of Brazilian market (70). Trade repetition time is

least in case of South African market (29.12 days) and maximum in case of Brazilian market (42.8 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor desires to be more active in case of South African stock market. The gross return for the data period is found to be maximum in case of Indian market (75.05%) and least in case of South African market (-29.30%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Indian market (4.78%) and least in case of South African market (-4.07%). That's why the Indian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of transactions. As the frequency of trades are maximum in case of South African market that's why the maximum transaction cost is in case of South African Market (1.10%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Indian market (74.32%) and CAGR is also maximum in case of Indian market (4.74%). On the basis of CAGR in case of net returns the first rank is assigned to Indian market for this data period. Alpha return is maximum in case of Russian market i.e., 138.25 % and is in negative for South African market (-116.58%) and for Chinese market (-5.57%). Out of all the five markets taken for the study three markets have shown positive alpha returns and two markets i.e., South African market and Chinese market have shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-100 has shown Average efficiency for the given data period. The Sharpe ratio is highest i.e., 398.50 for Russian market and lowest i.e., -349.75 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.34: Risk-Return Analysis of Long-Short Strategy (5-100)

“Panel-II : Sub Sample Period i.e., 01 April 2008 to 31 March 2012”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	24	41.38	20.29	4.73	5	0.24	20.05	4.67	5	50.62	14.40
Russia	RTS I	28	35.68	35.36	7.86	3	0.30	35.06	7.80	3	166.32	57.70
India	CNX Nifty	18	55	50.97	10.85	1	0.18	50.79	10.81	1	184.65	39.59
China	Shanghai	24	40.63	44.48	9.64	2	0.24	44.24	9.59	2	351.29	87.07
South Africa	FTSE	18	56.67	34.84	7.76	4	0.18	34.66	7.72	4	78.18	15.27

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.34 depicts the results of EMA 5-100 for sub period i.e., from 1st April 2008 to 31st march 2012 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-100 and then checks the efficiency of EMA 5–100 for the sub period data. When analyzed the number of trades the maximum number of trades are done in case of Russian market (28) and the least number of trades are in case of South African and Indian market (18). Trade repetition time is least in case of Russian market (35.68 days) and maximum in case of South African market (56.67 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of Russian market for this period. The gross return for the data period is found to be maximum in case of Indian market (50.97%) and least in case of Brazilian market (20.29%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Indian market (10.85%) and least in case of Brazilian market (4.73%) that’s why the Indian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of trades. As the frequency of transactions are maximum in case of Russian market that’s why the maximum transaction cost is in case of Russian Market (0.30%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Indian

market (50.79%) and CAGR is also maximum in case of Indian market (10.81%). On the basis of CAGR in case of net returns the first rank is assigned to Indian market for this data period. Alpha return is maximum in case of Chinese market i.e., 87.07 % and lowest for Brazilian market i.e., 14.40%. Out of all the five markets taken for the study all five markets have shown positive alpha returns. So, on the basis of alpha returns we can say that EMA 5-100 has shown very good efficiency for the given data period. The Sharpe ratio is highest i.e., 351.29 for Chinese market and lowest i.e., 50.62 in case of Brazilian market. When checked for Sharpe ratio, Chinese market shows the best performance and the least performed market is Brazilian market.

Table-4.35: Risk-Return Analysis of Long-Short Strategy (5-100)

“Panel-III : Sub Sample Period i.e., 01 April 2012 to 31 March 2016”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	30	33.83	-31.12	-8.90	5	0.30	-31.42	-9.00	5	-21.27	-6.05
Russia	RTS I	30	33.5	-1.54	-0.39	1	0.31	-1.85	-0.47	1	174.96	60.70
India	CNX Nifty	32	30.91	-8.73	-2.26	3	0.32	-9.05	-2.34	3	-219.12	-46.98
China	Shanghai	30	32.4	-27.05	-7.58	4	0.30	-27.35	-7.68	4	-224.64	-55.68
South Africa	FTSE	34	30.44	-7.26	-1.87	2	0.36	-7.62	-1.96	2	-271.67	-53.06

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.35 depicts the results of EMA 5-100 for sub period i.e., from 1st April 2012 to 31st march 2016 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-100 and then checks the efficiency of EMA 5–100 for the sub period data. When analyzed the number of trades the maximum number of trades are done in case of South African market (34) and the least number of trades are in case of Brazilian, Russian and Chinese market (30). Trade repetition time is least in case of South African market (30.44 days) and maximum in case of Brazilian market (33.83 days). The less is trade repetition time more active one need to be in the

market. So, we can say that an investor needs to be more active in case of South African stock market for this period. The gross return for the data period is found to be in negative for all the five markets. The highest negative return is given by Brazilian market (-31.12%). When the gross return is converted into CAGR i.e., compound annual growth rate, the lowest CAGR is found to be for Brazilian market (-8.90%). The return given by Russian market is also in negative but has the least negative return (-0.39%). That's why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of trades are maximum in case of South African market that's why the maximum transaction cost is in case of South African Market (0.36%). After adjusting the transaction cost, we reached the net returns. The net return for the data period is found to be in negative for all the five markets. The highest negative return is given by Brazilian market (-31.42%). When the net return is converted into CAGR i.e., compound annual growth rate, the lowest CAGR is found to be for Brazilian market (-9.00%). The return given by Russian market is also in negative but has the least negative return (-0.47%) that's why the Russian market is placed at first rank in terms of returns. Alpha return is maximum in case of Russian market i.e., 60.70 % and lowest for Chinese market i.e., 55.68%. Out of all the five markets taken for the study only one market has shown positive alpha return and remaining four markets have shown negative returns. So, on the basis of alpha returns we can say that EMA 5-100 has shown a very low efficiency for the given data period. The Sharpe ratio is highest i.e., 174.96 for Russian market and lowest i.e., -271.67 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.36: Risk-Return Analysis of Long-Short Strategy (5-100)

“Panel-IV : Sub Sample Period i.e., 01 April 2016 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe Ratio ^{4,5} (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	16	61.75	69.67	14.13	1	0.17	69.50	14.10	1	103.87	29.55
Russia	RTS I	28	35.96	29.14	6.60	3	0.29	28.85	6.54	3	57.27	19.87
India	CNX Nifty	22	44.77	32.80	7.35	2	0.22	32.58	7.30	2	120.34	25.80
China	Shanghai	46	21.15	-45.43	-14.05	4	0.46	-45.89	-14.23	4	-149.12	-36.96
South Africa	FTSE	54	19.11	-56.87	-18.96	5	0.54	-57.41	-19.22	5	-156.06	-30.48

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.36 depicts the results of EMA 5-100 for sub period i.e., from 1st April 2016 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-100 and then checks the efficiency of EMA 5–100 for the sub period data. When analyzed the number of trades, the maximum number of trades are done in case of South African market (54) and the least number of trades are in case of Brazilian market (16). Trade repetition time is least in case of South African market (19.11 days) and maximum in case of Brazilian market (61.75 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market for this period. The gross return for the data period is found to be maximum in case of Brazilian market (69.67%) and least in case of South African market (-56.87%). When the gross return is converted into CAGR i.e., compound annual growth rate, the maximum return is found in case of Brazilian market (14.13%) and least in case of South African market (-18.96%) that’s why the Brazilian market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of trades are maximum in case of South African stock market that’s why the maximum transaction cost is in case of South African Market (0.54%). After adjusting the transaction cost, we reached on the net returns. The maximum net

returns are in case of Brazilian market (69.50%) and CAGR is also maximum in case of Brazilian market (14.10%). On the basis of CAGR in case of net returns the first rank is assigned to Brazilian market for this data period. Alpha return is maximum in case of Brazilian market i.e., 29.55 % and is in negative for South African market (-30.48%) and for Chinese market (-36.96%). Out of all the five markets taken for the study three markets have shown positive alpha return and two markets have shown the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-100 has shown average efficiency for the given data period. The Sharpe ratio is highest i.e., 120.34 for Indian market and lowest i.e., -156.06 in case of South African market. When checked for Sharpe ratio, Indian market shows the best performance and the least performed market is South African market.

Table-4.37: Risk-Return Analysis of Long-Short Strategy (5–200)
“Panel-I : Whole Sample Period i.e., 01 April 2008 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio ⁵ (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	52	57.61	46.46	3.23	1	0.52	45.94	3.20	1	90.37	25.71
Russia	RTS I	78	38.60	19.63	1.50	3	0.83	18.80	1.45	3	273.86	95.01
India	CNX Nifty	64	46.31	37.97	2.72	2	0.66	37.31	2.68	2	171.41	36.75
China	Shanghai	74	39.46	-54.07	-6.28	5	0.74	-54.81	-6.40	5	-220.00	-54.58
South Africa	FTSE	88	35.08	-29.13	-2.83	4	0.94	-30.07	-2.94	4	-348.00	-67.97

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.37 depicts the results of EMA 5-200 for the whole period i.e., from 1st April 2008 to 31st March 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-200 and then checks the efficiency of EMA 5–200 for the whole period data. When analyzed the number of trades, the maximum number of trades are done in case of South African market (88) and the least number of trades are in case of Brazilian market (52). Trade repetition time was

least in case of South African market (35.08 days) and maximum in case of Brazilian market (57.61 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market. The gross return for the data period is found to be maximum in case of Brazilian market (46.46%) and least in case of Chinese market (-54.07%). When the gross return is converted into CAGR i.e. Compound Annual Growth Rate, the maximum return is found in case of Brazilian stock market (3.23%) and least in case of Chinese market (-6.28%). That's why the Brazilian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of trades. As frequency of trades are maximum in case of South African market that's why the maximum transaction cost is in case of South African Market (0.94%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Brazilian market (45.94%) and CAGR is also maximum in case of Brazilian market (3.20%). On the basis of CAGR in case of net returns the first rank is assigned to Brazilian market for this data period. Alpha return is maximum in case of Russian market (95.01%) and is in negative for South African market (-67.97%). Out of all the five markets taken for the study three markets have shown positive alpha returns and two markets i.e., Chinese and South African market shows the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-200 has shown good efficiency for the given data period. The Sharpe ratio is 273.86 for Russian market and -348.00 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.38: Risk-Return Analysis of Long-Short Strategy (5-200)**“Panel-II: Sub Sample Period 01 April 2008 to 31 March 2012”**

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe Ratio ^{4,5} (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	14	70.93	40.00	8.78	1	0.14	39.86	8.75	1	120.00	34.21
Russia	RTS I	24	41.62	39.03	8.59	2	0.26	38.77	8.54	2	177.00	61.41
India	CNX Nifty	18	55.00	8.91	2.16	4	0.19	8.72	2.11	4	40.00	8.61
China	Shanghai	30	32.50	-12.10	-3.17	5	0.30	-3.47	-0.88	5	-12.27	-3.04
South Africa	FTSE	06	170.00	36.27	8.04	3	0.06	36.21	8.03	3	86.12	16.82

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.38 depicts the results of EMA 5–200 for the period from 1st April 2008 to 31st march 2012 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-200 and then checks the efficiency of EMA 5-200 for the period of four years. When analyzed the number of trades, the maximum number of trades are done in case of Chinese market (30) and the least number of trades are in case of South African market (06). Trade repetition time is least in case of Chinese market (32.50 days) and maximum in case of South African market (170.00 days). The less is trade repetition time more active one need to be in the market. So, we can say that an investor needs to be more active in case of Chinese stock market. The gross return for the data period is found to be maximum in case of Brazilian stock market (40.00%) and least in case of Chinese market (-12.10%). When the gross return is converted into CAGR i.e., Compound Annual Growth Rate, the maximum return is found in case of Brazilian market (8.78%) and least in case of Chinese market (-3.17%). That’s why the Brazilian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of transactions. As frequency of transactions are maximum in case of Chinese market that’s why the maximum transaction cost is in case of Chinese Market (0.30%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Brazilian

market (39.86%) and CAGR is also maximum in case of Brazilian market (8.75%). On the basis of CAGR in case of net returns the first rank is assigned to Brazilian market for this data period. Alpha return is maximum in case of Russian market (61.41%) and is in negative for Chinese market (-3.04%). Out of all the five markets taken for the study four markets have shown positive alpha returns and only one market i.e., Chinese market shows the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-200 has shown good efficiency for the given data period. The Sharpe ratio is 177.00 for Russian market and -12.27 in case of Chinese market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is Chinese market.

Table-4.39: Risk-Return Analysis of Long-Short Strategy (5-200)
“Panel-II: Sub Sample Period 01 April 2012 to 31 March 2016”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	30	33.83	-46.72	-14.56	5	0.30	-47.02	-14.68	5	-76.10	-21.65
Russia	RTS I	16	62.81	26.54	6.06	1	0.18	26.36	6.02	1	256.27	88.91
India	CNX Nifty	32	30.91	-4.12	-1.05	4	0.33	-4.45	-1.13	4	-22.53	-4.83
China	Shanghai	14	69.43	9.17	2.22	3	0.14	9.03	2.18	3	35.30	8.75
South Africa	FTSE	14	73.93	17.11	4.03	2	0.16	16.95	3.99	2	-145.87	-28.49

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.39 depicts the results of EMA 5–200 for the period from 1st April 2012 to 31st march 2016 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-200 and then checks the efficiency of EMA 5-200 for the period of four years. When analyzed the number of trades, the maximum number of trades are done in case of Indian market (32) and the least number of trades are in case of Chinese and South African market (14 and 14). Trade repetition time is least in case of Indian market (30.91 days) and maximum in case of South African market (73.93 days). The less is trade repetition time, more active one need to be in the

market. So, we can say that an investor needs to be more active in case of Indian market. The gross return for the data period is found to be maximum in case of Russian market (26.54%) and least in case of Brazilian market (-46.72%). When the gross return is converted into CAGR i.e., Compound Annual Growth Rate, the maximum return is found in case of Russian market (6.06%) and least in case of Brazilian market (-14.56%). That's why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of transactions. As the frequency of trades are maximum in case of Indian market that's why the maximum transaction cost is in case of Indian Market (0.33%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Russian market (26.36%) and CAGR is also maximum in case of Russian market (6.02%). On the basis of CAGR in case of net returns the first rank is assigned to Russian market for this data period. Alpha return is maximum in case of Russian market (88.91%) and is in negative for Brazilian, Indian and South African market (-21.65, -4.83 and -28.49%). Out of all the five markets taken for the study two markets i.e., Russian and Chinese have shown positive alpha returns and three markets i.e., Brazilian, Indian and South African market shows the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-200 has shown low efficiency for the given data period. The Sharpe ratio is 256.27 for Russian market and -28.49 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.40: Risk-Return Analysis of Long-Short Strategy (5-200)

“Panel-III: Sub Sample Period 01 April 2016 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	08	123.5	53.45	11.3	2	0.08	53.37	11.28	1	47.17	13.42
Russia	RTS I	38	26.5	-45.95	-14.26	4	0.39	-46.34	-14.41	4	-159.46	-55.32
India	CNX Nifty	14	70.36	33.19	7.43	3	0.14	33.05	7.40	2	153.82	32.98
China	Shanghai	30	32.43	-51.14	48.86	1	0.30	-51.44	-16.52	5	-207.19	-51.35
South Africa	FTSE	68	15.18	-82.51	-35.33	5	0.70	-12.51	-3.29	3	73.81	14.42

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns - Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns - Index Return).”

Table 4.40 depicts the results of EMA 5–200 for the period from 1st April 2016 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of EMA 5-200 and then checks the efficiency of EMA 5-200 for the period of four years. When analyzed the number of trades, the maximum number of trades are done in case of South African market (68) and the least number of trades are in case of Brazilian market (08). Trade repetition time is least in case of South African market (15.18 days) and maximum in case of Brazilian market (123.5 days). The less is trade repetition time, more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market. The gross return for the data period is found to be maximum in case of Brazilian stock market (53.45%) and least in case of South African market (-82.51%). When the gross return is converted into CAGR i.e. Compound Annual Growth Rate, the maximum return is found in case of Chinese market (48.86%) and least in case of South African market (-35.33%) that’s why the Chinese market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of trades. As the number of transactions are maximum in case of South African market that’s why the maximum transaction cost is in case of South African market (0.70%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Brazilian market (53.37%) and CAGR is also maximum in case of Brazilian

market (11.28%). On the basis of CAGR in case of net returns the first rank is assigned to Brazilian market for this data period. Alpha return is maximum in case of Indian market (32.98%) and is in negative for Russian and Chinese market (-55.32 and -51.35%). Out of all the five markets taken for the study three Brazilian, Indian and South African markets have shown positive alpha returns and two markets i.e. Russian and Chinese market shows the negative alpha returns. So, on the basis of alpha returns we can say that EMA 5-200 has shown good efficiency for the given data period. The Sharpe ratio is 153.82 for Indian market and -207.19 in case of Chinese market. When checked for Sharpe ratio, Indian market shows the best performance and the least performed market is Chinese market.

Table-4.41: Risk-Return Analysis of Long-Short Strategy (RSI)

“Panel-I : Whole Sample Period i.e., 01 April 2008 to 31 March 2020”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio ⁵ (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	726	4.13	-31.42	-3.09	4	7.24	-38.66	-3.99	4	207.00	-58.89
Russia	RTS I	628	4.79	273.55	11.61	1	6.22	267.33	11.45	1	990.23	343.54
India	CNX Nifty	666	4.45	99.50	5.92	2	6.66	92.84	5.62	2	430.41	92.28
China	Shanghai	696	4.20	-11.67	-1.03	3	6.96	-18.63	-1.70	3	-74.22	-18.40
South Africa	FTSE	798	3.87	-61.85	-7.72	5	8.02	-69.87	-9.51	5	-551.79	-107.77

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.41 depicts the results of RSI for the period from 1st April 2008 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of RSI and then checks the efficiency of RSI for the period of twelve years. When analyzed the number of trades, the maximum number of trades are done in case of South African market (798) and the least number of trades are in case of Russian market (628). Trade repetition time is least in case of South African market (3.87 days) and maximum in case of Russian market (4.79 days). The less is trade repetition time, more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market. The gross return for the data

period is found to be maximum in case of Russian market (273.55%) and least in case of South African market (-61.85%). When the gross return is converted into CAGR i.e., Compound Annual Growth Rate, the maximum return is found in case of Russian market (11.61%) and least in case of South African market (-7.72%) that's why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of frequency. As frequency of transactions are maximum in case of South African market that's why the maximum transaction cost is in case of South African market (8.02%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Brazilian market (53.37%) and CAGR is also maximum in case of Brazilian market (11.28%). On the basis of CAGR in case of net returns the first rank is assigned to Brazilian market for this data period. Alpha return is maximum in case of Russian market (343.54) and is in negative for Brazilian, South African and Chinese market (-58.89, -107.77 and -18.40). Out of all the five markets taken for the study two, Indian and Russian markets have shown positive alpha returns and three markets i.e., Brazilian, South African and Chinese market shows the negative alpha returns. So, on the basis of alpha returns we can say that RSI has shown low efficiency for the given data period. The Sharpe ratio is 990.23 for Russian market and -551.79 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.42: Risk-Return Analysis of Long-Short Strategy (RSI)

“Panel-II: 01 April 2008 to 31 March 2012”

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	216	4.60	-18.56	-5.00	4	2.14	-20.70	-5.63	4	-92.62	-26.35
Russia	RTS I	174	5.74	181.92	29.58	1	1.76	180.16	29.38	1	584.56	202.8
India	CNX Nifty	230	4.30	56.51	11.85	2	2.30	54.21	11.44	2	251.07	53.83
China	Shanghai	178	5.48	-41.31	-12.47	5	1.78	-43.09	-13.14	5	-172.12	-42.66
South Africa	FTSE	248	4.11	-12.21	-3.2	3	2.36	-14.57	-3.86	3	-173.88	-33.96

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.42 depicts the results of RSI for the period from 1st April 2008 to 31st March 2012 for all the five markets taken for the study. This table represents the risk return analysis of RSI and then checks the efficiency of RSI for the period of four years. When analyzed the number of trades, the maximum number of trades are done in case of South African market (248) and the least number of trades are in case of Russian market (174). Trade repetition time is least in case of South African market (4.11 days) and maximum in case of Russian market (5.74 days). The less is trade repetition time, more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market. The gross return for the data period is found to be maximum in case of Russian market (181.92%) and least in case of Chinese market (-41.31%). When the gross return is converted into CAGR i.e. Compound Annual Growth Rate, the maximum return is found in case of Russian market (29.58%) and least in case of Chinese market (-12.47%). That's why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with number of trades. As frequency of transactions are maximum in case of South African market that's why the maximum transaction cost is in case of South African market (2.36%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Russian market (180.16%) and CAGR is also maximum in case of Russian market (29.38%). On the basis of CAGR in case of net returns the first rank is assigned to Russian market for this data period. Alpha return is maximum in case of Russian market (202.8%) and is in negative for Brazilian, Chinese and South African market (-26.35, -42.66 and -33.96%). Out of all the five markets taken for the study two markets i.e., Russian and Indian markets have shown positive alpha returns and three markets i.e., Brazilian, Chinese and South African market shows the negative alpha returns. So, on the basis of alpha returns we can say that RSI has shown low efficiency for the given data period. The Sharpe ratio is 584.56 for Russian market and -173.88 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

Table-4.43: Risk-Return Analysis of Long-Short Strategy (RSI)**“Panel-III: 01 April 2012 to 31 March 2016”**

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe Ratio ^{4,5} (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	222	4.57	7.27	-1.87	4	2.22	5.05	-1.29	4	106.93	30.42
Russia	RTS I	192	5.23	100.83	19.04	1	1.93	98.90	18.76	1	465.37	161.45
India	CNX Nifty	221	4.48	14.92	3.54	3	2.21	12.71	3.04	3	57.51	12.33
China	Shanghai	241	4.03	49.93	10.66	2	2.41	47.52	10.21	2	190.60	47.24
South Africa	FTSE	300	3.45	-26.07	-7.27	5	3.02	-29.09	-8.24	5	-381.60	-74.53

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.43 depicts the results of RSI for the period from 1st April 2012 to 31st march 2016 for all the five markets taken for the study. This table represents the risk return analysis of RSI and then checks the efficiency of RSI for the period of four years. When analyzed the number of trades, the maximum number of trades are done in case of South African market (300) and the least number of trades are in case of Russian market (192). Trade repetition time is least in case of South African market (3.45 days) and maximum in case of Russian market (5.23 days). The less is trade repetition time, more active one need to be in the market. So, we can say that an investor needs to be more active in case of South African stock market. The gross return for the data period is found to be maximum in case of Russian market (100.83%) and least in case of South African market (-26.07%). When the gross return is converted into CAGR i.e., Compound Annual Growth Rate, the maximum return is found in case of Russian market (19.04%) and least in case of South African market (-7.27%). That’s why the Russian market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the number of trades are maximum in case of South African market that’s why the maximum transaction cost was in case of South African market (3.02%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Russian market (98.90%) and

CAGR is also maximum in case of Russian market (18.76%). On the basis of CAGR in case of net returns the first rank is assigned to Russian market for this data period. Alpha return is maximum in case of Russian market (161.45%) and is in negative for South African market (-74.53%). Out of all the five markets taken for the study four markets have shown positive alpha returns and only one market i.e., South African market shows the negative alpha returns. So, on the basis of alpha returns we can say that RSI has shown good efficiency for the given data period. The Sharpe ratio is 465.37 for Russian market and -381.60 in case of South African market. When checked for Sharpe ratio, Russian market shows the best performance and the least performed market is South African market.

**Table-4.44: Risk-Return Analysis of Long-Short Strategy (RSI)
“Panel-IV: 01 April 2016 to 31 March 2020”**

Markets	Indices	Quantity of Trades ¹	Trade Recurrence Time ² (Number of Days)	Gross Returns (%)			Trade Cost (%) ³	Net Returns (%)			Sharpe ⁴ Ratio ⁵ (%)	Alpha ⁶ (↑Index Return)
				Total	CAGR	Position		Total	CAGR	Position		
Brazil	Bovespa	288	3.43	-20.14	-5.47	3	2.88	-23.02	-6.33	3	-221.34	-62.97
Russia	RTS I	262	3.84	-9.21	-2.39	2	2.52	-11.73	-3.07	2	-59.70	-20.71
India	CNX Nifty	215	4.58	28.06	6.38	1	2.15	25.91	5.93	1	120.52	25.84
China	Shanghai	277	3.51	-20.28	-5.51	4	2.77	-23.05	-6.34	4	-92.64	-22.96
South Africa	FTSE	250	4.13	-23.56	-6.5	5	2.5	-26.06	-7.27	5	4.45	0.87

“1) The amount of trades is determined as follow: one buys “Z” quantity on a particular day so that he can hold the long position and then selling “2Z” quantity in order to do a neutral trade and then also taking a short position. 2) The amount of days between two trades that are repeated on average has a direct impact on the transaction cost. The projected transaction cost, is taken as 0.01 percent on the basis of average trade value. Transaction costs are often dependent on volume of trades made by each client and are virtually non-existent for stock exchange members, who purchase a seat for a one-time fee. So, it is presumed that transaction costs exist. 4) The Sharpe Ratio is calculated as (Net Returns -Index Return)/Standard Deviation. 5) Annual standard deviation is arrived by calculating the SD for a particular year on the basis of indices return and then it is multiplied by square root of average number of days for the selected indices 6) Alpha Ratio = (Net Returns – Index Return).”

Table 4.44 depicts the results of RSI for the period from 1st April 2016 to 31st march 2020 for all the five markets taken for the study. This table represents the risk return analysis of RSI and then checks the efficiency of RSI for the period of four years. When analyzed the number of trades, the maximum number of trades are done in case of Brazilian market (288) and the least number of trades are in case of Indian market (215). Trade repetition time is least in case of Brazilian market (3.43 days) and maximum in case of Indian market (4.58 days). The less is trade repetition time, more active one need to be in the market. So, we can say that an investor needs to be more active in case of Brazilian stock market. The gross return for the data period is found

to be maximum in case of Indian market (28.06%) and least in case of South African market (-23.56%). When the gross return is converted into CAGR i.e Compound Annual Growth Rate, the maximum return is found in case of Indian market (6.38%) and least in case of South African market (-6.5%). That's why the Indian market is placed at first rank in terms of returns. Transaction cost has direct relation with frequency of transactions. As the frequency of trades are maximum in case of Brazilian market that's why the maximum transaction cost was in case of Brazilian market (2.88%). After adjusting the transaction cost, we reached on the net returns. The maximum net returns are in case of Indian market (25.91%) and CAGR is also maximum in case of Indian market (5.93%). On the basis of CAGR in case of net returns the first rank is assigned to Indian market for this data period. Alpha return is maximum in case of Indian market (25.84%) and is in negative for Brazilian, Russian and Chinese markets (-62.97, -20.71 and -22.96%). Out of all the five markets taken for the study two markets have shown positive alpha returns and three markets i.e., Brazilian, Russian and Chinese markets have shown the negative alpha returns. So, on the basis of alpha returns we can say that RSI has shown low efficiency for the given data period. The Sharpe ratio is 120.52 for Indian market and -221.34 in case of Brazilian market. When checked for Sharpe ratio, Indian market shows the best performance and the least performed market is Brazilian market.

Part IV: - In this part ALPHA returns generated by techniques are analyzed.

In order to test whether there is any significant difference between the alpha returns earned by the investor by using the different techniques of technical analysis or not, the researcher has used ANOVA technique. The following null hypothesis are created: -

H₀₁: - There is no significant difference in Alpha returns **on the basis of technique** used by the technical analysis

H₀₂: - There is no significant difference in Alpha returns **in different markets** by the using technical analysis

Table 4.45: Alpha returns of markets on the basis of different techniques of Technical Analysis
“For Whole Period i.e., from 1st April 2008 to 31st March 2020”

Markets	Indices	Alpha (↑Index Return) EMA 5-20	Alpha (↑Index Return) EMA 5-50	Alpha (↑Index Return) EMA 5-100	Alpha (↑Index Return) EMA 5-200	Alpha (↑Index Return) RSI
Brazil	Bovespa	79.22	97.99	37.91	25.71	-58.89
Russia	RTS I	358.81	201.23	138.25	95.01	343.54
India	CNX Nifty	53.46	25.48	18.41	36.75	92.28
China	Shanghai	126.12	69.54	-5.57	-54.58	-18.40
South Africa	FTSE	-122.53	-116.58	-68.31	-67.97	-107.77
ANOVA: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
Column 1	5	495.08	99.016	29944.35		
Column 2	5	277.66	55.532	13438.12		
Column 3	5	120.69	24.138	5668.306		
Column 4	5	34.92	6.984	4598.371		
Column 5	5	250.76	50.152	32345.04		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F critical
Between Groups	24561.05	4	6140.263	0.357016	0.836107	2.866081
Within Groups	343976.8	20	17198.84			
Total	368537.8	24				
ANOVA: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
Column 1	5	181.94	36.388	3705.905		
Column 2	5	1136.84	227.368	14229.2		
Column 3	5	226.38	45.276	865.6775		
Column 4	5	117.11	23.422	5336.919		
Column 5	5	-483.16	-96.632	704.0825		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F critical
Between Groups	269170.7	4	67292.68	13.54425	0.00002	2.866081
Within Groups	99367.12	20	4968.356			
Total	368537.8	24				

Table 4.45 depicts the results of alpha return for the whole period data by using the different techniques of technical analysis taken for the study. From the table we find that the value of f statistics is found to be 0.357016 and p value is found to be 0.836107. So, our null hypothesis has been accepted for the whole period data and we conclude that there is no significant difference in alpha return on the basis of techniques used on all the five markets. But when the analysis is done on the basis of different markets, we found significant difference in the alpha returns. The value of f statistics is 13.54425 and p value is 0.00002. So, in this case our second null hypothesis (H_{02}) is rejected and we conclude that there is significant difference in the returns on the basis of different markets.

Table 4.46 Alpha returns of markets on the basis of different techniques of Technical Analysis

“For Sub Period i.e., from 1st April 2008 to 31st March 2012”

Markets	Indices	Alpha (↑Index Return) EMA 5-20	Alpha (↑Index Return) EMA 5-50	Alpha (↑Index Return) EMA 5-100	Alpha (↑Index Return) EMA 5-200	Alpha (↑Index Return) RSI
Brazil	Bovespa	34.79	57.37	14.40	34.21	-26.35
Russia	RTS I	218.34	162.78	57.70	61.41	202.8
India	CNX Nifty	11.70	30.56	39.59	8.61	53.83
China	Shanghai	109.38	92.91	87.07	-3.04	-42.66
South Africa	FTSE	-34.62	-54.63	15.27	16.82	16.82
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
EMA 5-20	5	339.59	67.918	9779.461		
EMA 5-50	5	288.99	57.798	6409.055		
EMA 5-100	5	214.03	42.806	939.1519		
EMA 5-200	5	118.01	23.602	630.6316		
RSI	5	204.44	40.888	9615.869		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>

Between Groups	5778.908	4	1444.727	0.263885	0.89765	2.866081
Within Groups	109496.7	20	5474.834			
Total	115275.6	24				
ANOVA: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
34.79	4	79.63	19.9075	1259.363		
218.34	4	484.69	121.1725	5331.516		
11.7	4	132.59	33.1475	359.3519		
109.38	4	134.28	33.57	4511.597		
-34.62	4	-5.72	-1.43	1258.418		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	35157.28	4	8789.321	3.454855	0.034313	3.055568
Within Groups	38160.74	15	2544.049			
Total	73318.02	19				

Table 4.46 depicts the results of alpha return for the sub period from 1st April 2008 to 31st March 2012 data by using the different techniques of technical analysis taken for the study. From the table we find that the value of f statistics is found to be 0.263885 and p value is found to be 0.89765. So, our null hypothesis has been accepted for the whole period data and we conclude that there is no important difference in alpha return on the basis of techniques used on all the five markets. But when the analysis is done on the basis of different markets, we found significant difference in the alpha returns. The value of f statistics is 3.454855 and p value is 0.034313. So, in this case our second null hypothesis (H_{02}) is rejected and we conclude that there is significant difference in the returns on the basis of different markets.

Table 4.47 Alpha returns of markets on the basis of different techniques of Technical Analysis

“For Sub-Period i.e., from 1st April 2012 to 31st March 2016”

Markets	Indices	Alpha (↑Index Return) EMA 5-20	Alpha (↑Index Return) EMA 5-50	Alpha (↑Index Return) EMA 5-100	Alpha (↑Index Return) EMA 5-200	Alpha (↑Index Return) RSI
Brazil	Bovespa	64.17	2.05	-6.05	-21.65	30.42
Russia	RTS I	113.54	50.07	60.70	88.91	161.45
India	CNX Nifty	-33.58	-49.35	-46.98	-4.83	12.33
China	Shanghai	26.98	-8.03	-55.68	8.75	47.24
South Africa	FTSE	-39.41	-50.36	-53.06	-28.49	-28.49
ANOVA: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
EMA 5-20	5	131.7	26.34	4237.207		
EMA 5-50	5	-55.62	-11.124	1732.131		
EMA 5-100	5	-101.07	-20.214	2450.202		
EMA 5-200	5	42.69	8.538	2230.199		
RSI	5	222.95	44.59	5061.366		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	14120.05	4	3530.014	1.123414	0.373473	2.866081
Within Groups	62844.42	20	3142.221			
Total	76964.48	24				
ANOVA: Single Factor						

SUMMARY						
Groups	Count	Sum	Average	Variance		
Column 1	5	68.94	13.788	1150.537		
Column 2	5	474.67	94.934	1997.899		
Column 3	5	-122.41	-24.482	737.1689		
Column 4	5	19.26	3.852	1531.664		
Column 5	5	-199.81	-39.962	135.7986		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	54752.21	4	13688.05	12.32477	0.00003	2.866081
Within Groups	22212.27	20	1110.613			
Total	76964.48	24				

Table 4.47 depicts the results of alpha return for the sub period from 1st April 2012 to 31st march 2016 data by using the different techniques of technical analysis taken for the study. From the table we find that the value of f statistics is found to be 1.123414 and p value is found to be 0.373473. So, our null hypothesis has been accepted for the whole period data and we conclude that there is no important difference in alpha return on the basis of techniques used on all the five markets. But when the analysis is done on the basis of different markets, we found significant difference in the alpha returns. The value of f statistics is 12.32477 and p value is 0.00003. So, in this case our second null hypothesis (H_{02}) is rejected and we conclude that there is significant difference in the returns on the basis of different markets.

Table 4.48 Alpha returns of markets on the basis of different techniques of Technical Analysis

“For Sub Period i.e., from 1st April 2016 to 31st March 2020”

Markets	Indices	Alpha (↑Index Return) EMA 5-20	Alpha (↑Index Return) EMA 5-50	Alpha (↑Index Return) EMA 5-100	Alpha (↑Index Return) EMA 5-200	Alpha (↑Index Return) RSI
Brazil	Bovespa	-19.74	38.57	29.55	13.42	-62.97
Russia	RTS I	26.93	-11.71	19.87	-55.32	-20.71
India	CNX Nifty	39.82	44.27	25.80	32.98	25.84

China	Shanghai	-9.26	-15.35	-36.96	-51.35	-22.96
South Africa	FTSE	-48.46	-11.56	-30.48	14.42	-56.28
ANOVA: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
EMA 5-20	5	-10.71	-2.142	1277.926		
EMA 5-50	5	44.22	8.844	890.6941		
EMA 5-100	5	7.78	1.556	1054.156		
EMA 5-200	5	-45.85	-9.17	1688.098		
RSI	5	-137.08	-27.416	1249.561		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	3802.282	4	950.5706	0.771512	0.556439	2.866081
Within Groups	24641.74	20	1232.087			
Total	28444.03	24				
ANOVA: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
Column 1	5	-1.17	-0.234	1723.89		
Column 2	5	-40.94	-8.188	1102.789		
Column 3	5	168.71	33.742	68.46962		
Column 4	5	-135.88	-27.176	289.6802		
Column 5	5	-132.36	-26.472	820.6441		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	12422.14	4	3105.534	3.876614	0.017257	2.866081
Within Groups	16021.89	20	801.0945			
Total	28444.03	24				

Table 4.48 depicts the results of alpha return for the sub period from 1st April 2016 to 31st march 2020 data by using the different techniques of technical analysis taken for the study. From the table we find that the value of f statistics is found to be 0.771512 and p value is found to be 0.556439. So, our null hypothesis has been accepted for the whole period data and we conclude that there is no significant difference in alpha return on the basis of techniques used on all the five markets. But when the analysis is done on the basis of different markets, we found significant difference in the alpha returns. The value of f statistics is 3.876614 and p value is 0.017257. So, in this case our second null hypothesis (H_{02}) is rejected and we conclude that there is significant difference in the returns on the basis of different markets.

Table 4.49 Alpha returns of EMA 5-20 on the different blocks

Markets	Indices	2008-2012	2012-2016	2016-2020		
Brazil	Bovespa	34.79	64.17	-19.74		
Russia	RTS I	218.34	113.54	26.93		
India	CNX Nifty	11.7	-33.58	39.82		
China	Shanghai	109.38	26.98	-9.26		
South Africa	FTSE	-34.62	-39.41	-48.46		
ANOVA: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
Column 1	5	339.59	67.918	9779.461		
Column 2	5	131.7	26.34	4237.207		
Column 3	5	-10.71	-2.142	1277.926		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	12413.93	2	6206.965	1.217482	0.33006	3.885294
Within Groups	61178.38	12	5098.198			
Total	73592.31	14				

Table 4.49 depicts the results of alpha returns for EMA 5-20. The data of alpha returns are taken for each block i.e., for 2008 to 2012, 2012-2016 and 2016-2020. The

results are then analyzed by using ANOVA. Form the above table we found that the value of f statistics is 1.217482 and critical value of f is found to be 3.885294. So, on the basis of it we accept our null hypothesis and conclude that there is no significant difference in alpha return using EMA 5-20 for different block of four years each. The p value (0.33006) is also supporting the same fact.

Table 4.50 Alpha returns of EMA 5-50 on the different blocks

Markets	Indices	2008-2012	2012-2016	2016-2020		
Brazil	Bovespa	57.37	2.05	38.57		
Russia	RTS I	162.78	50.07	-11.71		
India	CNX Nifty	30.56	-49.35	44.27		
China	Shanghai	92.91	-8.03	-15.35		
South Africa	FTSE	-54.63	-50.36	-11.56		
ANOVA: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
Column 1	5	288.99	57.798	6409.055		
Column 2	5	-55.62	-11.124	1732.131		
Column 3	5	44.22	8.844	890.6941		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	12575.76	2	6287.881	2.088562	0.166602	3.885294
Within Groups	36127.52	12	3010.627			
Total	48703.28	14				

Table 4.50 depicts the results of alpha returns for EMA 5-50. The data of alpha returns are taken for each block i.e., for 2008 to 2012, 2012-2016 and 2016-2020. The results are then analyzed by using ANOVA. Form the above table we found that the value of f statistics is 2.088562 and critical value of f is found to be 3.885294. So, on the basis of it we accept our null hypothesis and conclude that there is no significant difference in alpha return using EMA 5-50 for different block of four years each. The p value (0.166602) is also supporting the same fact.

Table 4.51 Alpha returns of EMA 5-100 on the different blocks

Markets	Indices	2008-2012	2012-2016	2016-2020		
Brazil	Bovespa	14.4	-6.05	29.55		
Russia	RTS I	57.7	60.7	19.87		
India	CNX Nifty	39.59	-46.98	25.8		
China	Shanghai	87.07	-55.68	-36.96		
South Africa	FTSE	15.27	-53.06	-30.48		
ANOVA: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
Column 1	5	214.03	42.806	939.1519		
Column 2	5	-101.07	-20.214	2450.202		
Column 3	5	7.78	1.556	1054.156		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	10245.03	2	5122.513	3.458423	0.065162	3.885294
Within Groups	17774.04	12	1481.17			
Total	28019.07	14				

Table 4.51 depicts the results of alpha returns for EMA 5-100. The data of alpha returns are taken for each block i.e., for 2008 to 2012, 2012-2016 and 2016-2020. The results are then analyzed by using ANOVA. From the above table we found that the value of f statistics is 3.458423 and critical value of f is found to be 3.885294. So, on the basis of it we accept our null hypothesis and conclude that there is no significant difference in alpha return using EMA 5-100 for different block of four years each. The p value (0.065162) is also supporting the same fact.

Table 4.52 Alpha returns of EMA 5-200 on the different blocks

Markets	Indices	2008-2012	2012-2016	2016-2020			
Brazil	Bovespa	34.21	-21.65	13.42			
Russia	RTS I	61.41	88.91	-55.32			
India	CNX Nifty	8.61	-4.83	32.98			
China	Shanghai	-3.04	8.75	-51.35			
South Africa	FTSE	16.82	-28.49	14.42			
ANOVA: Single Factor							
SUMMARY							
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>			
Column 1	5	118.01	23.602	630.6316			
Column 2	5	42.69	8.538	2230.199			
Column 3	5	-45.85	-9.17	1688.098			
ANOVA							
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>	
Between Groups	2690.836	2	1345.418	0.887298	0.437134	3.885294	
Within Groups	18195.71	12	1516.31				
Total	20886.55	14					

Table 4.52 depicts the results of alpha returns for EMA 5-200. The data of alpha returns are taken for each block i.e., for 2008 to 2012, 2012-2016 and 2016-2020. The results are then analyzed by using ANOVA. From the above table we found that the value of f statistics is 0.887298 and critical value of f is found to be 3.885294. So, on the basis of it we accept our null hypothesis and conclude that there is no significant difference in alpha return using EMA 5-200 for different block of four years each. The p value (0.437134) is also supporting the same fact.

Table 4.53 Alpha returns of RSI on the different blocks

Markets	Indices	2008-2012		2012-2016	2016-2020	
Brazil	Bovespa	-26.35		30.42	-62.97	
Russia	RTS I	202.8		161.45	-20.71	
India	CNX Nifty	53.83		12.33	25.84	
China	Shanghai	-42.66		47.24	-22.96	
South Africa	FTSE	-33.96		-74.53	0.87	
Anova: Single Factor						
SUMMARY						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
Column 1	5	153.66	30.732	10742.68		
Column 2	5	176.91	35.382	7167.604		
Column 3	5	-79.93	-15.986	1077.997		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	8071.442	2	4035.721	0.637612	0.545552	3.885294
Within Groups	75953.11	12	6329.426			
Total	84024.56	14				

Table 4.53 depicts the results of alpha returns for RSI. The data of alpha returns are taken for each block i.e., for 2008 to 2012, 2012-2016 and 2016-2020. The results are then analyzed by using ANOVA. Form the above table we found that the value of f statistics is 0.637612 and critical value of f is found to be 3.885294. So, on the basis of it we accept our null hypothesis and conclude that there is no significant difference in alpha return using RSI for different block of four years each. The p value (0.545552) is also supporting the same fact.

CHAPTER- 5

FINDINGS AND RECOMMENDATIONS

Any type of research work is based on a very deep study. The work starts with identification of problem and then continue with an extensive review of literature. The present work is also an outcome of the extensive literature along with the proper analysis of data. Technical analysis is always a great area for the researcher and academicians. Various researcher has made every possible effort to find out the effectiveness of technical analysis on the various markets. The markets taken by the researcher are mostly developed markets and this research is based on BRICS in which both developed and developing countries are members. The data engaged for the study is for a longer time (12 Years) which is also broken into four sub-periods (04 years each), so that both long term and short-term analysis can be made.

In the era, where every person is eager to make quick money out of the markets, technical analysis becomes a very hot area for research. In technical analysis most prominent techniques which is used by the researcher worldwide are Moving Average and RSI. There is a very limited work done on taking the many techniques on a particular group of countries which has a good recognition in the world. The present study gives an attempt to check the application of moving average and RSI on BRICS nation.

5.1 Profile, Objectives, Hypothesis and Methodology

5.1.1 Description of the markets & indices

The researcher has considered 5 market of the known as BRICS. The study period comprises the data from April 1st, 2008 to December 31st, 2020). The study has been conducted from the perspective of Indian Investor considering 5 markets.

Table 5.1: Countries with their respective indexes

Country	Index
Brazil	IBOVESPA Index
Russia	RTSI
India	S&P CNX Nifty
China	Shanghai Composite Index
South Africa	FTSE

5.1.2 Research Objectives

The present study is started with the extensive review of literature and from the available literature the gap is discovered. In the light of the gap and consultation with the experts in the area the following research objectives are formulated: (a) To study the effectiveness of EMA for predicting the equity indices of BRICS (b) To examine the efficiency of EMA in generating alpha returns. (c) To study the effectiveness of RSI in equity indices of BRICS. (d) To make comparative analysis of Alpha returns on BRICS.

5.1.3 Research Hypothesis

H₁: In any of the chosen markets, the return from the active strategy employing the EMA 5–20 is either lower than or equal to the return from the passive approach.

H₂ In any of the chosen markets, the return from the active strategy employing the EMA 5–50 is either lower than or equal to the return from the passive approach.

H₃: In any of the chosen markets, the return from the active strategy employing the EMA 5–100 is either lower than or equal to the return from the passive approach.

H₄: In any of the chosen markets, the return from the active strategy employing the EMA 5–200 is either lower than or equal to the return from the passive approach.

H₅: The return of active strategy using RSI is either less than or equal to the return given by the passive strategy in any of the selected markets

H₆: There is no significant difference in the Alpha Returns among BRICS. The following sub null hypothesis are created:-

H₀₁:- There is no significant difference in Alpha returns on the basis of technique used by the technical analysis.

H₀₂:- There is no significant difference in Alpha returns in different markets by the using technical analysis.

H₀₃:- There is no significant difference in Alpha returns among blocks using a specific technique of Technical analysis.

5.1.4 Data and Tools used in the research

The period of twelve years from April 1st, 2008 to March 31st, 2020 have been taken to carry out the present study. As in case of technical analysis it is very difficult to analyze such long data. Thus, the data have been broken in three sub-periods of 4 years each i.e. (2008-2012), (2012-2016), (2016-2020). The researcher has collected the data for all the markets for the complete time period of the study.

To analyze the collected data, various simple statistical techniques like “Average Standard Deviation, Compound Annual Average Growth Rate and Brock t-test have been used. The tools of technical analysis i.e., Exponential Moving Average & Relative Strength Index” have been used. To measure the efficiency of the respective markets Sharpe and Alpha ratios are also used.

5.2 Major Findings

5.2.1 Examining the Effectiveness of technical analysis using EMA: In the present study, to examine the Effectiveness of technical analysis two most prominent techniques of “technical analysis have been used which are Exponential Moving Average and Relative Strength Index”. Both of these techniques have been used on BRICS market. The major findings while using these techniques are as follows: -

5.2.1.1 Major findings for the complete period: EMA is used on complete set of data in four ways i.e., “EMA 5-20, EMA 5-50, EMA 5-100 and EMA 5-200”.

- While using EMA 5-20, on the whole period set of data it has been found that EMA 5-20 has its significant presence in Russian market. The return generated by Russian market using EMA 5-20 was found to be significant at 10% (in case of long strategy), at 5% (in case of short strategy) and at 1% in case of

aggregate strategy. The results of Chinese market were also found significant at 10% in case of aggregate strategy.

- While using EMA 5-50, on the whole period set of data it has been found that EMA 5-50 has its significant presence in Russian market. The return generated by Russian market using EMA 5-50 was found to be significant at 10% (in case of aggregate strategy).
- While using EMA 5-100, on the whole period set of data it has been found that EMA 5-100 has not shown any significant results in any of the markets under study.
- While using EMA 5-200, on the whole period set of data it has been found the EMA 5-200 has not shown any significant results in any of the markets under study.

5.2.1.2 Major findings for first sub-period: The first sub-period starts from 1st April 2008 and ends on 31st March, 2008. In this period too all EMA which are discussed earlier are used and major findings are as follows:

- While using EMA 5-20, on this sub period set of data it has been found the EMA 5-20 has its significant presence in Russian and chinese market. The return generated by Russian market using EMA 5-20 was found to be significant at 5% (in case of short strategy) and at 5% in case of aggregate strategy. The returns generated by Chinese market using EMA 5-20 was found to be significant at 10% (in case of short strategy) and at 10% in case of aggregate strategy.
- While using EMA 5-50, on this sub period set of data it has been found the EMA 5-50 has its significant presence in Russian market. The return generated by Russian market using EMA 5-50 was found to be significant at 10% (in case of short and aggregate strategy).
- While using EMA 5-100, on this sub period set of data it has been found the EMA 5-100 has shown any significant results only for Chinese market at 10% level in case of aggregate strategy.

- While using EMA 5-200, on this sub period set of data it has been found the EMA 5-200 has not shown any significant results in any of the markets under study.

5.2.1.3 Major findings for second sub-period: The second sub-period starts from 1st April 2012 and ends on 31st March, 2016. In this period too all EMA which are discussed earlier are used and major findings are as follows:

- While using EMA 5-20, on this sub period set of data it has been found the EMA 5-20 has its significant presence in Russian market. The return generated by Russian market using EMA 5-20 was found to be significant at 10% (in case of short strategy).
- While using EMA 5-50, on this sub period set of data it has been found the EMA 5-50 has not shown any significant results in any of the markets under study.
- While using EMA 5-100, on this sub period set of data it has been found the EMA 5-100 has not shown any significant results in any of the markets.
- While using EMA 5-200, on this sub period set of data it has been found the EMA 5-200 has not shown any significant results in any of the markets under study.

5.2.1.4 Major findings for third sub-period: The third sub-period starts from 1st April 2016 and ends on 31st March, 2020. In this period too all EMA which are discussed earlier are used and major findings are as follows:

- While using EMA 5-20, on this sub period set of data it has been found the EMA 5-20 has not shown any significant results in any of the markets under study.
- While using EMA 5-50, on this sub period set of data it has been found the EMA 5-50 has not shown any significant results in any of the markets under study.
- While using EMA 5-100, on this sub period set of data it has been found the EMA 5-100 has not shown any significant results in any of the markets.

- While using EMA 5-200, on this sub period set of data it has been found the EMA 5-200 has not shown any significant results in any of the markets under study.

5.2.1.5 Major findings from markets point of view: When the data is analysed for all the markets under study it has been found that out of all markets Russian markets shows the greatest presence of EMA. South African, Indian and Brazilian market never show any of the significant result whereas Chinese market have shown significant results in some case.

5.2.2 Examining the Effectiveness of technical analysis using RSI:

- While using RSI on the whole period data it has been found that it has generated statistically significant results in case of Russian market. It has generated statistically significant results at 10% level in case of long strategy, at 5% level in case of short strategy and at 1% level in case of aggregate strategy. Remaining four markets have nor generated any of the significant results using RSI for this time period.
- While using RSI on the first sub period data it has been found that it has generated statistically significant results in case of Russian market. It has generated statistically significant results at 10% level in case of short strategy and at 5% level in case of aggregate strategy. Remaining four markets have nor generated any of the significant results using RSI for this time period.
- While using RSI on the second sub period data it has been found that it has generated statistically significant results in case of Russian market. It has generated statistically significant results at 5% level in case of short strategy and at 5% level in case of aggregate strategy. Remaining four markets have nor generated any of the significant results using RSI for this time period.
- While using RSI on the third sub period data it has been found that it has not generated statistically significant results in any of the selected market.

5.2.3 Examining the efficiency of technical analysis using EMA: In the present study, in order to find out the efficiency of the markets, the researcher has used alpha ratio. Alpha ratio is calculated by taking the difference of net returns generated by the

techniques used in the selected market with the returns generated by passive strategy i.e. return generated by the index.

5.2.3.1 Major findings for the complete period: EMA is used on complete set of data in three ways i.e. EMA 5-20, EMA 5-50, EMA 5-100 and EMA 5-200.

- While using EMA 5-20 on the complete data set we found that out of the five markets four have generated positive alpha returns. Only South African market have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Chinese market.
- While using EMA 5-50 on the complete data set we found that out of the five markets four have generated positive alpha returns. Only South African market have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Brazilian market.
- While using EMA 5-100 on the complete data set we found that out of the five markets three have generated positive alpha returns. Chinese and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Brazilian market.
- While using EMA 5-200 on the complete data set we found that out of the five markets three have generated positive alpha returns. Chinese and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Indian market.

5.2.3.2 Major findings for first sub-period: The first sub-period starts from 1st April 2008 and ends on 31st March, 2020. In this period too all EMA which were discussed earlier are used and major findings are as follows:

- While using EMA 5-20 on this sub period data set we found that out of the five markets four have generated positive alpha returns. Only South African market have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Chinese market.
- While using EMA 5-50 on this sub period data set we found that out of the five markets four have generated positive alpha returns. Only South African

market have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Chinese market.

- While using EMA 5-100 on this sub period data set we found that all five markets three have generated positive alpha returns. The best alpha returns are generated by Chinese market followed by Russian market.
- While using EMA 5-200 on this sub period data set we found that out of the five markets four have generated positive alpha returns. Chinese market have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Brazilian market.

5.2.3.3 Major findings for second sub-period: The second sub-period starts from 1st April 2012 and ends on 31st March, 2016. In this period too all EMA which were discussed earlier are used and major findings are as follows:

- While using EMA 5-20 on this sub period data set we found that out of the five markets three have generated positive alpha returns. Indian and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Russian market followed by Brazilian market.
- While using EMA 5-50 on this sub period data set we found that out of the five markets two markets have generated positive alpha returns. Indian, Chinese and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Russian market.
- While using EMA 5-100 on this sub period data set we found that out of the five markets only one market have generated positive alpha returns. Brazilian, Indian, Chinese and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Russian market.
- While using EMA 5-200 on this sub period data set we found that all five markets three have generated positive alpha returns. The best alpha returns are generated by Russian market followed by Chinese market. The negative returns are generated by Brazilian, Indian and South African market.

5.2.3.4 Major findings for third sub-period: The third sub-period starts from 1st April 2016 and ends on 31st March, 2020. In this period too all EMA which were discussed earlier are used and major findings are as follows:

- While using EMA 5-20 on this sub period data set we found that out of the five markets two have generated positive alpha returns. Brazilian, Chinese and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Indian market followed by Russian market.
- While using EMA 5-50 on this sub period data set we found that out of the five markets two markets have generated positive alpha returns. Russian, Chinese and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Indian market followed by Brazilian market.
- While using EMA 5-100 on this sub period data set we found that out of the five markets three markets have generated positive alpha returns. Chinese and South African markets have generated negative alpha return for the period. The best alpha returns are generated by Brazilian market followed by Indian market.
- While using EMA 5-200 on this sub period data set we found that all five markets three have generated positive alpha returns. The best alpha returns are generated by Indian market followed by South African market. The negative returns are generated by Russian market and Chinese market.

5.2.3.5 Major findings from markets point of view: Out of all the markets taken for the study it has been found that Russian market is most predictable out of five markets. In most of the time period the alpha returns generated by Russian market is found to be positive. In some cases, the alpha returns generated by Russian market is highest out of all five markets. South African market mostly show negative alpha returns. Remaining three markets i.e., Indian market, Chinese market and Brazilian market have shown the mix results i.e., positive alpha returns in some cases and in some cases negative alpha returns.

5.2.4 Examining the efficiency of technical analysis using RSI:

- While using RSI for the complete data set for calculating the alpha returns it has been found that out of five markets three markets have generated negative alpha returns. The highest returns is generated by Russian market followed by Indian market.
- While using RSI for the first sub period data set for calculating the alpha returns it has been found that out of five markets three markets have generated negative alpha returns. The highest returns is generated by Russian market followed by Indian market.
- While using RSI for the second sub period data set for calculating the alpha returns it has been found that out of five markets only one market have generated negative alpha returns i.e. South African market. The highest returns is generated by Russian market followed by Chinese market.
- While using RSI for the third sub period data set for calculating the alpha returns it has been found that out of five markets three markets have generated negative alpha returns. The highest returns is generated by Indian market.

5.2.5 Testing alpha return among markets: While testing the alpha returns on the different market the researcher has used ANOVA technique. It has been found that alpha returns of different markets were statistically different. This statistical difference continues to exist in all data period i.e. in case of whole period data as well as in case of sub period data.

5.2.6 Testing alpha return among different sub periods: While testing the alpha returns on the different sub periods the researcher has used ANOVA technique. It has been found that alpha returns of different sub periods were not statistically different.

5.3 Conclusion: - The present research has been conducted in order to determine the both effectiveness and efficiency of BRICS for the selected time period of study. The researcher has used two most widely used techniques to find out the efficiency and effectiveness of technical analysis. The efficiency has been judged by calculating the index returns and active return of the different indexes by using the selected techniques. In order to judge the efficiency, the researcher has used Brock t statistics

on the different blocks of the time period. For testing the effectiveness of the selected return researcher has used Alpha returns. Alpha returns are calculated by using the difference of active strategy returns over the passive strategy for the different blocks of the time period. After making all the study we have reached on the conclusion that shorter EMA is more beneficial as compared to the larger EMA and RSI seems to be a good technique for predicting the most of the markets. Russian market seems to be most predictive market and rest of the markets have shown a very mixed result. ANOVA was used to find out whether any significant difference exist in the return of different markets as well as in different time periods. It is concluded that there is no significant difference between the return of different markets for the different time blocks but there is significant difference in alpha returns in different markets. So, it can be concluded that it is not necessary that these techniques are going to give the same return in every market. One should be very careful in using these techniques in any selected market.

5.4 Recommendations: The present research on technical analysis has put every effort to find out the application of technical analysis on the worldwide exchanges. But every research leaves some new era for further research. Some of the recommendations on the basis of the findings of the present research are as follows:-

- On the basis of the current research it is recommended that the researcher has to use shorter period of techniques in EMA. As we can observe from the research that shorter moving averages have given better results than the larger moving averages.
- The current research has also analyzed that the use of technical analysis techniques is not same in every sphere of time. As we can check from the results that the active strategy has given good alpha results in some blocks whereas in some blocks the results was not good. So it is recommended that the timing for entry and exit in a particular market must be taken care while using technical analysis.
- In the current research the researcher has used mainly two techniques which are EMA and RSI. It is recommended to use some more techniques of

technical analysis which may be helpful in bringing better returns in case of active strategy.

The present work done on BRICS has tried to find out the application of some of the most popular techniques of technical analysis. The researcher has tried each possible effort to get the maximum clarification and relation of the techniques with all the markets. The application of the techniques has provided a very mixed approach regarding the predicting power of technical analysis. Some of the markets are found to be more predictive and some are less predictive. But if the proper timing is judged and then investment is made, one can have maximum benefit out of the markets.

5.5 Suggestions:

The current research is conducted on a group of markets popularly known as BRICS after using some techniques of technical analysis which are EMA and RSI. After completing the current research, the research has the following suggestions for any further research that may be conducted in the field of technical analysis: -

1. More extensive research can be conducted by taking some more markets like the study can be made using top developed markets and top developing markets.
2. More techniques of technical analysis such as MACD (Moving Average Convergence and Divergence), Bollinger bands, Artificial Neural Networks and Fibonacci Technique etc. can be considered.

Data for the research can be increased so that more detailed analysis can be done.

5.6 Implications

- The research can be used by the investors for better investment decisions in currency and commodity markets.
- The research will work as a guiding tool for portfolio managers to find out the efficiency in any financial market.

Same techniques can also be used in more financial assets such as in case of currency, commodities etc.

REFERENCES:-

- Achelis, Steven B. (2001). *Technical Analysis from A to Z*. McGraw Hill, Inc., New York.
- Achuthan S.& Anubhai R. (2005). Effectiveness of variable length moving average (VMA) trading rules in the Indian stock markets. *Finance India*, 19(4), 1375-1391
- Aggarwal M., Khan A.U. & Shukla P.K. (2019). Stock Price Prediction using Technical Indicators: A Predictive Model using Optimal Deep Learning. *International Journal of Recent Technology and Engineering (IJRTE)*, 8(2), 2297–2305.
- Aguirre, A. A. A., Medina, R. A. R., & Méndez, N. D. D. (2020). Machine learning applied in the stock market through the Moving Average Convergence Divergence (MACD) indicator. *Investment Management & Financial Innovations*, 17(4), 44.
- Agustin I. N. (2019). The integration of fundamental and technical analysis in predicting the stock price. *Jurnal Manajemen Maranatha, Program Studi Manajemen, Fakultas Ekonomi, Universitas Kristen Maranatha*, 18 (2), pp 93–102.
- Almujafer H.I. , Fifield S.G.M. & Power D.M. (2018). An investigation of the weak form of the efficient markets hypothesis for the Kuwait stock exchange. *Journal of Emerging Market Finance*, 17(1), 1–28.
- Allen & Karjalainen (1999). Using genetic algorithms to find technical trading rules. *Journal of Financial Economics*, 51, 245-271.
- Anghel G. D. I. (2015). Stock market efficiency and the MACD. Evidence from countries around the world. *Procedia Economics and Finance*, 32, 1414 – 1431.
- Antoniou A., Ergul N., Holmes P. & Priestley R. (1997). Technical analysis, trading volume and market efficiency: evidence from an emerging market. *Applied Financial Economics*, 7, 361-365.

- Aronson D. R. (2007). *Evidence-based technical analysis: applying the scientific method and statistical inference to trading signals*. Hoboken, N.J.: John Wiley & Sons.
- Baccouche, Rafik, Kouki & Mokhtar (2003). Stochastic production frontier and technical inefficiency: A sensitivity analysis. *Econometric Reviews*, 22(1), 79-91.
- Balsara, Chen & Zheng (2007). The Chinese Stock Market: An Examination of the Random walk model and Technical Trading Rules. *Quarterly Journal of Business and Economics*, 46(2), 43-63.
- Barroso, B. C., Cardoso, R. T. N., & Melo, M. K. (2021). Performance analysis of the integration between Portfolio Optimization and Technical Analysis strategies in the Brazilian stock market. *Expert Systems with Applications*, 186, 115687.
- Bensignor R. (2000). *New thinking in technical analysis: trading models from the masters*. Princeton, NJ: Bloomberg Press.
- Bessembinder H. & Chan K. (1998). Market efficiency and the returns to technical analysis. *Financial Management*, 27(2),5-17
- Bhargavi R., Srinivas G. & Anith R. (2017). Relative strength index for developing effective trading strategies in constructing optimal portfolio. *International Journal of Applied Engineering Research*. 12 (17). pp 8926-8936.
- Blume L., Easley D. & O'Hara M. (1994). Market Statistics and Technical Analysis: The Role of Volume. *The Journal of Finance*, 49(1) ,153-181.
- Brock W., Lakonishok J. & LeBaron B. (1992). Simple Technical Trading Rules and the Stochastic Properties of Stock Returns. *The Journal of Finance*, 47(5), 1731-1764.
- Brown D. P. & Jennings R. H. (1989). On technical analysis. *The Review of Financial Studies*, 2(4), 527-551.

- Brown J., Goetzmann N. & Kumar A. (1998). The Dow Theory: William Peter Hamilton's Track Record Reconsidered. *The Journal of Finance*, Vol. LIII, No. 4, 1311-1333.
- Boobalan C. (2014). Technical analysis in select stocks of Indian companies. *International Journal of Business and Administration Research Review*. 2 (4). pp 26-36.
- Čaljkušić Veronika (2011). Fundamental and technical analysis on Croatian stock market. *Croatian Operational Research Review (CRORR)*, 2, 71-80.
- Chan K., Hameed A., & Tong W. (2000). Profitability of Momentum Strategies in the International Equity Markets. *The Journal of Financial and Quantitative Analysis*, 35(2), 153-172.
- Cheung W. & Wong P. (1997). The Performance of Trading Rules on Four Asian Currency Exchange Rates. *Multinational Finance Journal*, 1(1), 1-22.
- Cheung, William, Lam, Keith S.K and Yeung, Hang Fai (2009). Intertemporal profitability and the stability of technical analysis: evidences from the Hong Kong Stock Exchange. *Applied Economics*, 1-19.
- Chitra R. (2011). Technical analysis on selected stocks of energy sector. *International Journal of Management and Business Studies*. 1 (1). pp 42-46.
- Chong T.T. L., & Ng W.K. (2008). Technical analysis and the London stock exchange: Testing the MACD and RSI rules using the FT30. *Applied Economics Letters*, 15(14), 1111 — 1114.
- Chong T.T.L, Ng W.K., & Liew V.K.S. (2014). Revisiting the performance of MACD and RSI oscillators. *Journal of Risk and Financial Management*. 7. pp 1-12.
- Chong, Tai-Leung & Ng (2008). Technical analysis and the London Stock Exchange: testing the MACD and RSI rules using the FT 30. *Applied Economics Letters*, 15, 1111-1114.
- Ciana P., (2011). *New frontiers in technical analysis effective tools and strategies for trading and investing*. Hoboken, N.J.: Bloomberg Press.

- Coutts Andrew J. (2010). Trading rules and stock returns: some further short run evidence from the Hang Seng 1997-2008. *Applied Financial Economics*, 20, 1667-1672.
- Dalton J. M. (1993). *How the stock market works* (2nd ed.). New York: New York Institute of Finance.
- Dawson & Steeley (2003). On the Existence of Visual Technical Patterns in the UK Stock Market. *Journal of Business Finance & Accounting*, 30(1) & (2), 0306-686X.
- Daniswara D.A., Widjanarko H. & Hikmah K. (2022). The Accuracy Test of Technical Analysis of Moving Average, Bollinger Bands, and Relative Strength Index on Stock Prices of Companies Listed In LQ45 Index. *Scientific Journal of Management & Business*, 6(2), 16-25.
- Denis A., Zoran B. & Jurica V. (2012). The effectiveness of the 50/200 dual exponential moving average crossover on the S&P 500. *ASBBS e journal*. 8 (1). pp 8-20.
- Edwards R. D., & Magee J. (1997). *Technical analysis of stock trends* (7th ed.). Chicago.
- Eng W. F. (1988). *The technical analysis of stocks, options, & futures: advanced trading systems and techniques*. Chicago, Ill.: ProbusPub.
- Eric, Andjelic & Redzepagic (2009). Application of MACD and RVI indicators as functions of investment strategy optimization on the financial market. *Zb.rad. Ekon. Fak. Rij.*, Vol. 27, 171-196.
- Fama E.F. (1969). Efficient capital market: A review of theory and empirical work. *Journal of Finance*, 25(2), 383-417.
- Fifield, Power & Knipe (2008). The Performance of moving average rules in emerging stock markets. *Applied Financial Economics*, 18, 1515-1532.
- Fyee C., Marney J. & Tarbert H. (1999). Technical analysis versus market efficiency -a genetic programming approach. *Applied Financial Economics*, 9, 183-191.

- Gang L. & Jin Z. (2014). Research on the effectiveness of technical indicators with the volume. *International Conference on Education, Management and Computing Technology (ICEMCT 2014)*, Published by Atlantis Press, 2014.
- Gencay R. (1998). Optimization of technical trading strategies and the profitability in security markets. *Economics Letters*, 59, 249-254
- Gerritsen D.F. (2016). Are chartists artists? The determinants and profitability of recommendations based on technical analysis. *International Review of Financial Analysis*. 47. pp 179–196.
- Ghobadi M., & Ghobadi M. (2015). Comparing abnormal returns and ranking of technical analysis indicators based on TOPSIS technique. *EKOONOMIKA*. 61 (4). pp 167-180.
- Gitman, Lawrence J., Joehni, Michael D. (2012). *Fundamentals of Investing*. Dorling Kindersley India Pvt. Ltd., New Delhi.
- Gujarati, Damodar N. (2004). *Basic Econometrics*. Tata McGraw Hill Education Pvt. Ltd., New Delhi.
- Hassan M. Kabir, Haque Mahfuzul and Lawrence Shari B. (2006). An empirical analysis of emerging stock markets of Europe. *Quarterly Journal of Business and Economics*, 45(1/2), 31-52.
- Hayes et.al (2016). Effects of time horizon and asset condition on the profitability of technical trading rules. *J Econ Finance*, 40, pp41–59.
- Hoffmann A.O.I. & Shefrin H. (2014). Technical analysis and individual investors. *Journal of Economic Behavior & Organization*. 107. pp 487-511.
- Horne James C. vanes & Parker George G.C. (1968). Technical trading rules: A comment. *Financial Analysts Journal*, 24(4), 128-132.
- Ijegwa, A. D., Vincent, O. R., Folorunso, O., & Isaac, O. O. (2014). A Predictive Stock Market Technical Analysis Using Fuzzy Logic. *Comput. Inf. Sci.*, 7(3), 1-17.
- James F.E. (1968). Monthly moving average- An effective investment tool? *Journal of Financial and Quantitative Analysis*, 3(3), 315-326.

- J.L. Bettman, Sault and Schultz (2009). Fundamental and technical analysis: substitutes or complements? *Accounting and Finance*, 49, 21-36.
- Joshi, Prashant (2011). *Volatility in Indian Stock Markets*. Himalaya Publishing House, New Delhi.
- Kaseera A. (2023). Study on Relative Strength Index and Moving Average Convergence Divergence in Capital Market. *International Journal of Creative Research Thoughts*, 11(3),167-171.
- Kothari C.R. (2004). *Research Methodology – Methods and Techniques*. New Age International (P) Limited, Publishers, New Delhi.
- Krausz J., Lee S.Y., & Nam K. (2009). Profitability of nonlinear dynamics under technical trading rules: Evidence from Pacific basin stock markets. *Emerging Markets Finance & Trade*, 45(4), 13-35.
- Kresta A. & Franek J. (2015). Analysis of moving average rules applicability in Czech stock market. *Procedia Economics and Finance*. 30. 364-371.
- Kulshrestha N., Srivastavas V.K., & Singh N. (2020). The Test of Predictive Power of “Moving Average” Indicator on Indian Stock Market through System Design & Back Testing Strategy. *Test Engineering & Management*. 83. 15634-15645.
- Kung J. J. & Wong K.W. (2009). Profitability of technical analysis in the Singapore stock market: before and after the Asian financial crisis. *Journal of Economic Integration*, 24(1), 135-150.
- Lai H. W., Chen C.W. & Huang C.S. (2010). Technical analysis, investment psychology, and liquidity provision: Evidence from the Taiwan stock market. *Emerging Markets Finance & Trade*, 46(5), 18-38.
- Lai. Ming-Ming, Balachandher & Nor (2002). An Examination of the Random Walk Model and Technical Trading Rules in the Malaysian Stock Market. *Quarterly Journal of Business and Economics*, Vol. 41, No. ½, PP. 81-104.

- Li, A. W., & Bastos, G. S. (2020). Stock market forecasting using deep learning and technical analysis: a systematic review. *IEEE access*, 8, 185232-185242.
- Li X., Wu P., Wang W. (2020). Incorporating stock prices and news sentiments for stock market prediction: A case of Hong Kong. *Information Processing and Management*, 57(5), 102212
<https://doi.org/10.1016/j.ipm.2020.102212>.
- Maillet B. & Michel T. (2000). Further insights on the puzzle of technical analysis profitability. *The European Journal of Finance*, 6, 196-224.
- Maillet & Michel (2005). Technical Analysis Profitability when Exchange Rates are Pegged: A Note. *The European Journal of Finance*, Vol. 11, No. 6, 463-470.
- Mak D. K. (2006). *Mathematical techniques in financial market trading*. Hackensack, N.J.: World Scientific.
- Malkiel B. G. (1989). Is the stock market efficient? *Science, New Series*, 243(4896), 1313-1318.
- Marshall B. R., Cahan R. H. & Cahan J. (2010). Technical Analysis Around the World Available at SSRN <https://ssrn.com/abstract=1181367> or <http://dx.doi.org/10.2139/ssrn.1181367>.
- Masry M. (2017). The impact of technical analysis on stock returns in an emerging capital markets (ECM's) country: Theoretical and empirical study. *International Journal of Economics and Finance*, 9(3), 91-107.
- Mc Dowell B. (2008). *The art of trading combining the science of technical analysis with the art of reality based trading*. Hoboken, N.J.: John Wiley & Sons.
- Mc Kenzie Michael D. (2007). Technical trading rules in emerging markets and the 1997 Asian currency crises. *Emerging Markets Finance & Trade*, 43(4), 46-73.

- Metghalchi (2005). Market Efficiency for S&P 500: 1954-2004. *International Business & Economics Research Journal*, Vol. 4, No. 7, 23-30.
- Metghalchi M., Chang Y.H, & Gomez X.G. (2012). Technical Analysis of the Taiwanese Stock Market. *International Journal of Economics and Finance*,4(1). 90-102.
- Metghalchi M., Du J. & Ning Y. (2009). Validation of moving average trading rules: Evidence from Hong Kong, Singapore, South Korea, Taiwan. *Multinational Business Review*,17(3),101-122.
- Mills T. C. (1997). Technical analysis and the london stock exchange: Testing trading rules using the FT30. *Int. J. Fin. Econ.* 2, 319-331.
- Mizrach & Weerts (2009). Highs and Lows: a behavioural and technical analysis, *Applied Financial Economics*, 19, 767-777.
- Mizuno H., Kosaka M., Yajma H. & Komodo N. (1998). Application of Neutral Network to Technical Analysis of Stock Market Prediction. http://www.ki.ro/ici/revista/sic98_2/art03.html.
- Mudgal M. (2019). Sentimental and Technical Analysis for Stock Market Prediction. *International Journal of Research and Analytical Reviews (IJRAR)*, 6 (2), pp 8–9.
- Murphy J. J. (1999). Technical analysis of the financial markets. Fishkill, N.Y.: New York Institute of Finance.
- Nithya J. & Thamizhchelvan G. (2014). Effectiveness of technical analysis in banking sector of equity market. *IOSR Journal of Business and Management (IOSR-JBM)*. 16(7). pp 20-28.
- Nor S. M. & Wickremasinghe G. (2014). The profitability of MACD and RSI trading rules in the Australian stock market. *Investment Management and Financial Innovations*, 11(4), 194-199.
- Nti, I. K., Adekoya, A. F., & Weyori, B. A. (2020). A systematic review of fundamental and technical analysis of stock market predictions. *Artificial*

Intelligence Review, 53(4), 3007-3057. <https://doi.org/10.1007/s10462-019-09754-z>.

- Panday H. (2013). Technical analysis for selected companies of Indian IT sector, *International Journal of Advanced Research*. 1(4). pp 430-446.
- Park, C. H. & Irwin S. H. (2007). What do we know about the Profitability of Technical Analysis? *Journal of Economic Surveys*, Vol. 21, No. 4, pp. 786-826.
- Pauwels S., Inghelbrecht K., Heyman D. & Marius P. (2011). Technical trading rules in emerging stock markets. *International Journal of Economics and Management Engineering*, 5 (11). 1731-1754.
- Pramudya R. & Ichsani S. (2020). Efficiency of technical analysis for the stock trading. *International Journal of Finance & Banking Studies*. 9(1). 58-67.
- Raissi S. & Zakizadeh M.R. (2011). Profitability of Iranian stock market based on technical analysis trading rules. *Journal of Optimization in Industrial Engineering*. 9. 21-26.
- Ready M.J. (2002). Profits from technical trading rules. *Financial Management*, 31(3), 43-61.
- Rodriguez F., Rivero S. & Felix J. (2003). Technical Analysis in Foreign exchange markets: evidence from the EMS. *Applied Financial Economics*, 13, 113-122.
- Rosillo R., Fuentea D. & Brugos J. (2013). Technical analysis and the Spanish stock exchange: Testing the RSI, MACD, momentum and stochastic rules using Spanish market companies. *Applied Economics*, 45, 1541–1550.
- Sagala, T. W., Saputri, M. S., Mahendra, R., & Budi, I. (2020, January). Stock price movement prediction using technical analysis and sentiment analysis. In *Proceedings of the 2020 2nd Asia Pacific Information Technology Conference* (pp. 123-127).

- Shah D., Isah H. & Zulkernine F. (2019). Stock Market Analysis: A Review and Taxonomy of Prediction Techniques. *International Journal of Financial Studies*, 7, 26; doi:10.3390/ijfs7020026.
- Shaw A. R. (1988). *Technical analysis*. Homewood, Ill.: Dow Jones-Irwin.
- Singla, R. & Malik, N.S. (2016). Role of EMA in technical analysis: A study of leading stock markets worldwide. *Finance India*, XXX (3), pp 919–942.
- Standfield K. (2005). *Intangible finance standards advances in fundamental analysis & technical analysis*. Burlington, MA: Elsevier Academic Press.
- Stevens L. (2002). *Essential technical analysis: tools and techniques to spot market trends*. New York, NY: Wiley.
- Sundhar & Kakani (2006). Profiting from Technical Analysis in Indian Equity Markets: Using Moving Averages. *XLRI Working Paper*: 06-02, 1-20.
- Sulistiawan D., Rudiawarni F. A. & Feliana Y.K. (2020). Examining trading strategies using trend following indicators for Indonesian stock market, *Int. J. Trade and Global Markets*, 13(1), 52-60.
- Talreja P. (2014). Forecasting stock market trend using Relative Strength Index. *IJLTEMAS*, III (VI), pp174–178.
- Teixeira L.A. & Oliveira A.L.I. (2009). Predicting stock trends through technical analysis and nearest neighbor classification, *IEEE International Conference on Systems, Man, and Cybernetics*, San Antonio, TX, USA.
- Thawornwong, Enke & Dagli (2003). Neural Networks as a Decision Maker for Stock Trading: A Technical Analysis Approach, *International Journal of Smart Engineering System Design*, 5: 313-325.
- Tharavanij P., Siraprapasiri V. & Rajchamaha K. (2015). Performance of technical trading rules: evidence from Southeast Asian stock markets. *Springer Plus*. 4. pp 1-40.
- Tilehnoei M.H. & Shivaraj B. (2013). A comparative study of two technical analysis tools: moving average convergence and divergence V/S relative strength index: A case study of HDFC bank ltd listed in national stock

exchange of India (NSE), *International Journal of Management and Business Research*. 3 (3). pp 191-197.

- Treynor J. L. & Ferguson R. (1985). In Defense of Technical Analysis. *The Journal of Finance*, 40(3), 757-773.
- Ugur Sahin, U & Ozbayoglu, M.A. (2014). TN-RSI: Trend-normalized RSI indicator for stock trading systems with evolutionary computation. *Procedia Computer Science*, 36, pp 240-245.
- Ward & Terblanche (2009). Market timing on the JSE using exchange rate fluctuations. *Investment Analysts Journal*, 70, 1-10.
- Wong, Manzur & Chew (2003). How rewarding is technical analysis? Evidence from Singapore Stock Market. *Applied Financial Economics*, 13, 543-551.
- Yen & Hsu (2010). Profitability of technical analysis in financial and commodity future markets- A reality check. *Decision Support Systems*, 50, 128-139.
- Zakamulin, V. (2014). The real-life performance of market timing with moving average and time-series momentum rules. *Journal of Asset Management*, 15 (4), pp 261–278.
- Zhu H., Jiang Z.Q., Li S.P. & Zhoua W.X. (2015). Profitability of simple technical trading rules of Chinese stock exchange indexes. *Physica A*. 439. pp 75-84.

Websites:-

- <http://en.wikipedia.org/wiki?curid=2945461>
- <http://www.mybooklibrary.com/pdf/credit-suisse-technical-analysis-explained.pdf>
- <http://www.studymode.com/essays/Technical-Analysis-Of-Sbi-52348775.html>
- <http://www.investopedia.com/university/technical/techanalysis8.asp>
- <http://www.mudraa.com/trading/197703/0/technical-analysis-chart-patterns.html>
- <http://www.forexct.com.au/article.aspx?title=wedge>

APPENDIX

Flow Chart for Calculating Alpha Returns using the techniques of Technical Analysis

INTRODUCTION

There is always a demand from most of the industries about the methodology that one has used in any research work. So now many of the researcher now makes a comprehensive model of the technique that one has used in his research. The present research is based on alpha returns and has a very precise and proper methodology to calculate the alpha returns. The researcher has used the difference between the returns of active strategy and returns of passive strategy of the selected markets. The model thus is based on the proper methodology of calculating alpha return in a very precise way.

IDEALOGY

It is really a great matter of concern of how one can take a better decision for investing his or her money in a particular market or stock. A lot of academicians and analyst always claims that one can take a better decision if he properly use some most popular techniques of technical analysis. But any of investor is always looking for a complete proof of results which will convince him that when you are going to use such technique of technical analysis it is going to provide you the better return over the buy and hold strategy. So in this research our main focus is on developing and giving them a particular model for calculating the Alpha Returns so that the investor can be sure about the return that he is going to earn in putting his money and making the changes in his investment as per the signals provide by any of the techniques of technical analysis. So in this research we have tried to give a straight and clear model of Alpha Return which can be used by the investor.

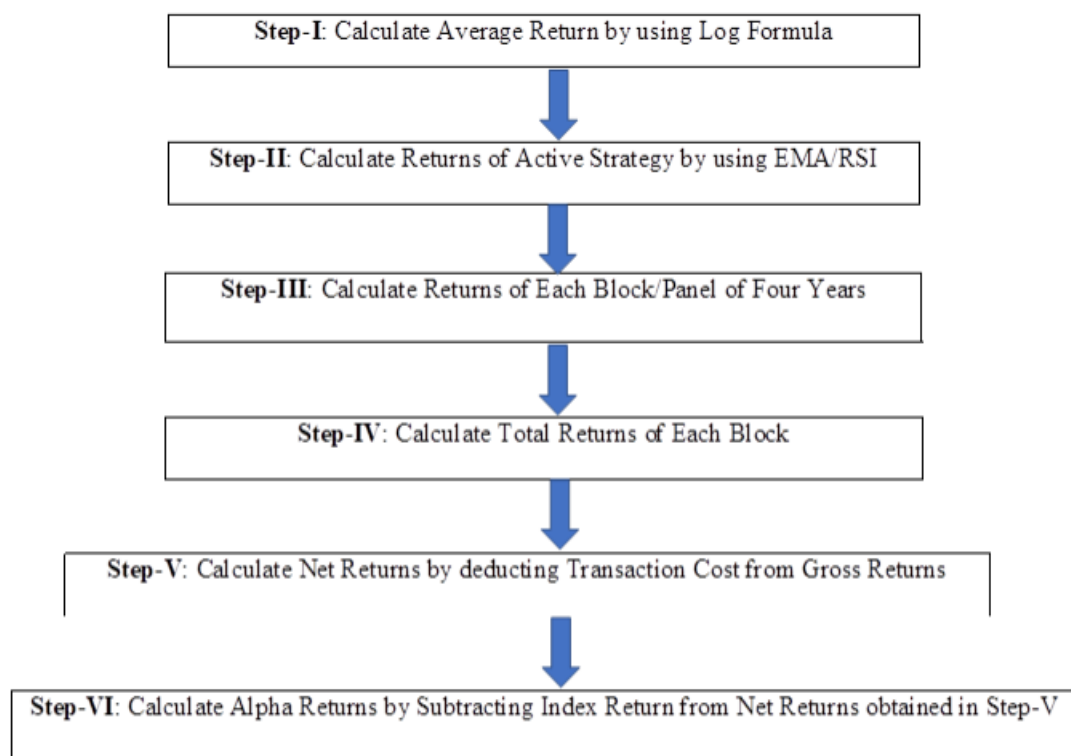
OBJECTIVE

- To develop a model for calculating the Alpha Return after using techniques of technical analysis.

METHODOLOGY

An extensive literature review was undertaken to find out the relevance of technical analysis among different markets both at national and international level. It has been observed that most of the researches have given a positive comment on using the techniques of technical analysis and has commented that it can give better returns over the normal buy and hold strategy. But it has been observed that none of the paper under review has given a clear cut model for calculating the extra returns that one has generated over the buy and hold strategy. So in this research we have used a new concept of Alpha returns so that a layman investor can also take a better decision of whether to invest in a particular market or not. This research offers a conceptual framework of calculating alpha return and giving a particular step to step model for calculating it with all suitable sequence.

Flow Chart for Calculating Alpha Returns based on Active Strategy



LIST OF PUBLICATIONS

- **Published Research Paper** titled “Testing the efficiency of EMA and RSI during Covid and Pre-Covid period: A Study on BRICS” in Scopus Indexed “Journal of Positive School Psychology” 2022, Vol. 6, No.6, 5948-5959.
- **Published Research Paper** titled “A Study of Some Selected Papers on Technical Analysis” in Scopus Indexed Journal “Turkish Online Journal of Qualitative Inquiry” in May 2021.
- **Published Research Paper** titled “Covid 19: Impact on Banking Sector in India” in “Vidyabharati International Interdisciplinary Research Journal” (Special Issue June 2020) ISSN 2319-4979. This research paper is available online at www.viirj.org.
- **Published Research Paper** titled “RSI based Alpha Return: A study of top three companies from Nifty Auto Index” in Scopus Indexed Journal “European Chemical Bulletin” (Special Issue 4) 2023, ISSN 2063-5346.

LIST OF CONFERENCES

- Attended and Presented Paper in ICSSR Sponsored **International Seminar** organized by Khalsa College for Women, Amritsar held on 14th -15th March, 2022.
- Attended and Presented Paper in DHE, Haryana sponsored **National Webinar** organized by S.A Jain (PG) College held on 12th March, 2022
- Attended and Presented Paper in DHE, Haryana sponsored **National Commerce Webinar** organized by Markanda National College held on 5th March, 2022.
- Attended **International Conference** organized by Chandigarh Group of Colleges and Presented a paper titled “A Study of Some Selected Papers on Technical Analysis” in 3rd International Virtual Conference on “The Ecology of New Economy Post Covid-19” on 23rd & 24th April, 2021.
- Presented Paper titled “Technical Analysis Techniques and a study of some selected papers” **in International Conference** on “Rethinking Business: Designing Strategies in the Age of Disruptions” held on December 19, 2020 organized by Mittal School of Business, Lovely Professional University, Punjab.

LIST OF WORKSHOPS

- Participated in one week **Short Term Course on Research Methodology**, organised by University Institute of Applied Management Sciences, Panjab University, Chandigarh, during 27th November-3rd December 2019.
- Attended National Faculty Development Programme on “**Research Methodology**” conducted by Government College for Girls, Ludhiana from 15th-20th March 2021.

LIST OF ABBREVIATIONS

EMA 5-20	Exponential Moving Average 5-20
EMA 5-50	Exponential Moving Average 5-50
EMA 5-100	Exponential Moving Average 5-100
EMA 5-200	Exponential Moving Average 5-200
EMH	Efficient Market Hypothesis
FA	Fundamental Analysis
FMA	Fixed Length Moving Average
RSI	Relative Strength Index
TA	Technical Analysis
TC	Transaction Cost
VMA	Variable Length Moving Average
Bm&f bovespa	IBOVESPA
RTS	Russian trading system
S&p cnx nifty	NIFTY
SSE	Shanghai stock exchange
JSE	JSE Limited