

Summer Internship Report
on
Derivatives Research Project on Indian Stocks Using
Volatility Skew Studies

Submitted By:

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Under the Guidance of:

Rahul Ingle

Co-founder, Research Head

Internship Industry:

Finance Industry



Delhi School of Management
Delhi Technological University

CERTIFICATE

This is to certify that the work titled '**Derivatives Research Project on Indian Stocks Using Volatility Skew Studies**' as part of Derivative Research at The Money Roller submitted by Vishal Chaudhary in the 3rd Semester of MBA (DSM, DTU) during August – November, 2020 was conducted under my guidance and supervision.

This work is his original work to the best of my knowledge and has not been submitted anywhere else for the award of any credits / degree whatsoever.

The project is submitted to Delhi School of Management, Delhi Technological University in partial fulfilment of the requirement for the award of degree of Masters of Business Administration. The work is satisfactory for the award of Summer Internship Report credits.

Ms. Niharika Kishor
Delhi School of Management,
Delhi Technological University



CERTIFICATE OF COMPLETION

This is to certify that
Mr/Miss. Vishal Chaudhary
has successfully completed
the Derivatives Research Project on
Indian Stocks Using Volatility Skew Studies
from 7th of May to 7th of July 2020.

THIS CERTIFICATE IS DIGITALLY GENERATED

NO SIGNATURE REQUIRED.

UNIQUE CERTIFICATE CODE: DRPMJ2020011




SIGNATURE
JANAK H. SHAH
CO-FOUNDER

DECLARATION

I hereby declare that the work titled '**Derivatives Research Project on Indian Stocks Using Volatility Skew Studies**' as part of Derivative Research at The Money Roller submitted by me as the Summer Internship Report for 3rd Semester in MBA (DSM, DTU) during August – November, 2020 under the guidance of Ms. Niharika Kishor is my original work to the best of my knowledge and has not been submitted anywhere else.

The report has been written by me in my own words and not copied from elsewhere. Anything that appears in this report which is not original has been duly and appropriately referred/ cited/ acknowledged.

Vishal Chaudhary
(2K19/DMBA/113)

ACKNOWLEDGEMENT

I would like to express my gratitude to The Money Roller for giving me this opportunity to intern in their organization and work directly under the guidance of Mr. Rahul Ingle and Mr. Janak Shah the co-founders of the organization. I'm thankful for their constant guidance and support throughout this internship. It was a wonderful learning experience.

It has been a pleasure interning at The Money Roller & it was one of the best professional experience I've had till date. The learnings, insights & exposure have been incredibly valuable. I could not have had such a splendid experience without my mentors Mr. Rahul Ingle & Mr. Janak Shah. It was great working with them, I thank them for being generous with their time and energy throughout. I am really thankful for the unparalleled support, their valuable ideas, thoughts that made it possible to complete my project with all the accurate information.

Lastly, I would like to thank Ms. Niharika Kishor for his mentorship in completing the Project Report and all the honorable faculty members of Delhi School of Management for sharing their experience and expertise on this Project.

I have put in all my efforts to ensure that the project is completed in the best possible manner and also ensured that the project is error free.

Vishal Chaudhary
(2K19/DMBA/113)

Derivatives Research Project on Indian Stocks Using Volatility Skew Studies

for The Money Roller

Vishal Chaudhary

Masters of Business Administration (M.B.A.)

Delhi School of Management, DTU

EXECUTIVE SUMMARY

Exploiting stock volatility of equity derivatives to form a right strategy was the objective of the internship at The Money Roller. Gathering historic data from the NSE's website for 3 various stocks was the first step.

Data was collected from the NSE indices for all the 3 firms which included their historic call and put options data for last 10 years. Then Implied Volatility (IV) for each underlying was calculated for each year separately. This is named as the Historic-IV which is further used to form a strategy.

Different techniques were employed to exploit the IV and strategies were formed accordingly. All the data collected was back tested to ensure the strength of the strategy formed. With each strategy the data was collected and prepared to use and was manipulated as per strategy's requirement. To ensure the accuracy of the strategy various conditions were set in place to ensure the consistency of the results received in each case.

Excel-VBA was used as a main tool to run all the analysis and back testing.

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Chapter 1

INTRODUCTION

1.1 COMPANY OVERVIEW:

The Money Roller is a financial service firm which deals in various aspects of financial markets. They provide services like financial consulting, mentoring, educating, researching, and report writing. They provide full array of services to their clients by backing up their findings with the thorough research. They run a unique research programs where they provide opportunities to college graduates to be a part of live projects where they educate them about the research and teach them techniques used in the industry to do the research on capital markets. With this comprehensive project structure, they derive value from young minds and enable them to think like a real financial researcher does.



Source: LinkedIn

They believe in the power of original research and that's why they have developed their corporate culture around that philosophy. They have their online portal by the name of TMRlive where they upload their research papers and conduct online projects. Anyone, who wishes to learn about financial world and wants to stay updated with what's going on the market can visit their portal. They also provide opportunities for young researchers and college graduates to be a part of a research projects in various fields ranging from equity to derivatives.

They also conduct weekly free sessions for finance enthusiasts pertaining to the current topics of finance which is impacting the financial markets. It is done to build the community of like-minded people who are self-driven and are willing to learn and understand financial markets. They also call guests in these sessions from various organizations who have hands on experience in the market to share their experience and views on the current market scenarios.

1.2 Organizational Structure

The organization has a pretty standard hierarchical structure. They have 40 people in the organization which works under 4 divisions which are Operations, Research, Admin & HR.

Operations: Their day to day activity involves trading, consulting, educating and other work-related profile duties. They trade in all major financial markets like capital market, money market, commodity market and derivatives market. Their trading depends heavily on the research of various financial market instruments which they do thoroughly to ensure the high profitability for their clients and test proof of their research work.

Research: Research team is responsible for the creating and finding new patterns in the financial markets of which to make a good return from. They focus on studying all the financial markets and the trading instruments in that market to have an edge over others. Each work is thoroughly done and back-tested multiple times to ensure the quality of the work and returns to be made from that work. Apart from the work done for ensuring the returns they also dabble in finding the macroeconomic impacts of various market activities and government policies.

Admin & HR: They're responsible for facilitating the staff members with adequate office supplies required to perform their day to day tasks and ensuring the quality of people that are getting hired in the organization.

1.3 Internship Program

The internship program which is being offered by the organization is of a researcher profile which tackles to find the caveats in capital markets. In the program students from various MBA colleges are hired as a researcher to work in the markets of equity and derivatives and done a thorough study on the allotted companies in different sectors.

The program is structured as an online research program where mentors teach and divide work among students which includes studying the financials of various organizations allotted to students to develop a profitable trading strategy at the end of the program. Each participant is allotted a different firm from various sectors like utility & energy, infrastructure, pharmaceuticals, IT, banking and others. The duration of program was of 2 months.

I was assigned the project in equity derivatives market where I was given 3 different stocks which were Indiabulls Housing Finance (IBULHSGFIN), NTPC (NTPC), and Nagarjuna Constructions Company (NCC). I performed number of tasks including calculating Implied volatility for each of these stocks using their last 10 years data. All the research done is backed by hard core data collected from sources like NSE and BSE. To make sure that strategy formed is useful various back-testing was also done on number of parameters using

tools like Excel, Excel-VBA, Python & Power BI.

1.4 Objectives of Summer Internship Project

The objectives of program were:

- To understand the impact of volatility skew on the underlying prices in equity derivatives market
- To develop profitable strategy to exploit the volatility in the market

The second objective was suggested to fulfill the first objective i.e. building profitable strategy to mitigate the risk occurred due to the volatility in the market and to ensure that the research done is right and actually works. Using this work, we can exploit the future scenarios of same degree and can actually make profit.

Chapter 2

CASE DISCUSSION

2.1 Work Output

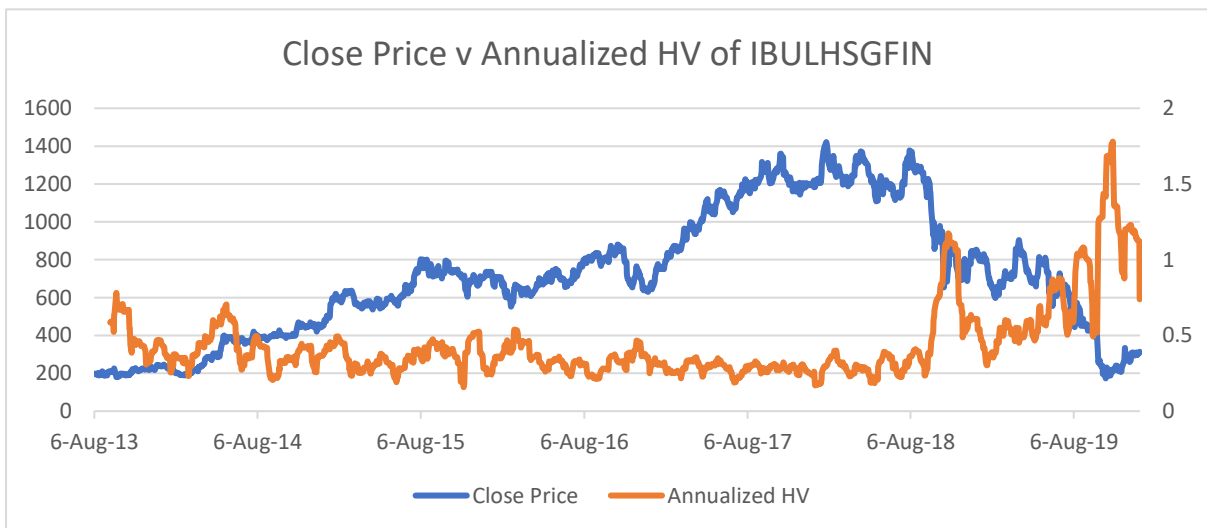
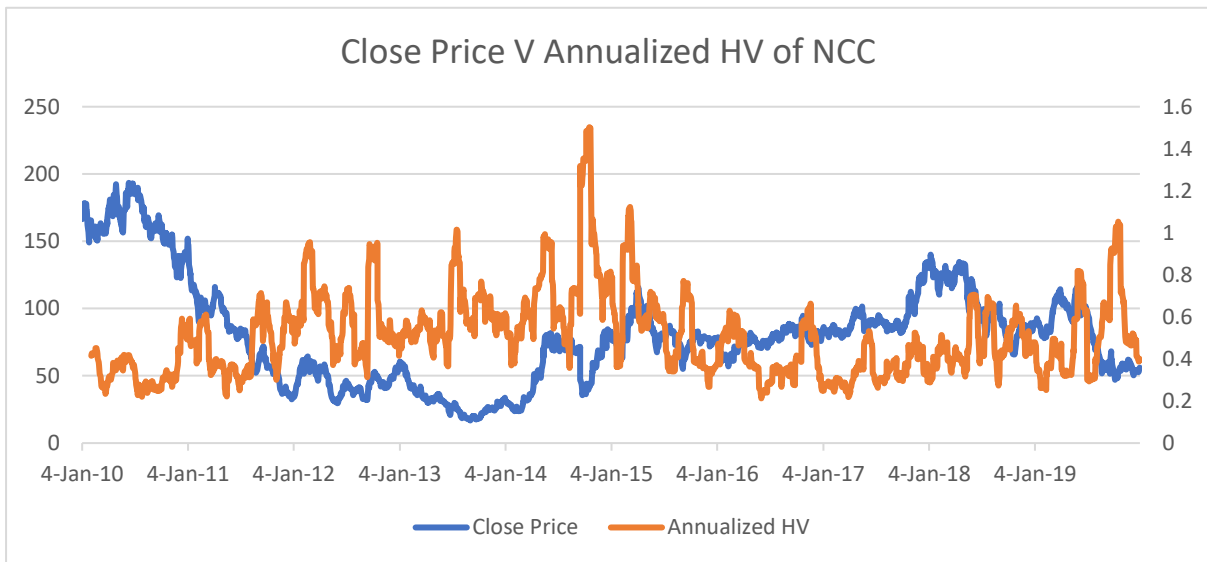
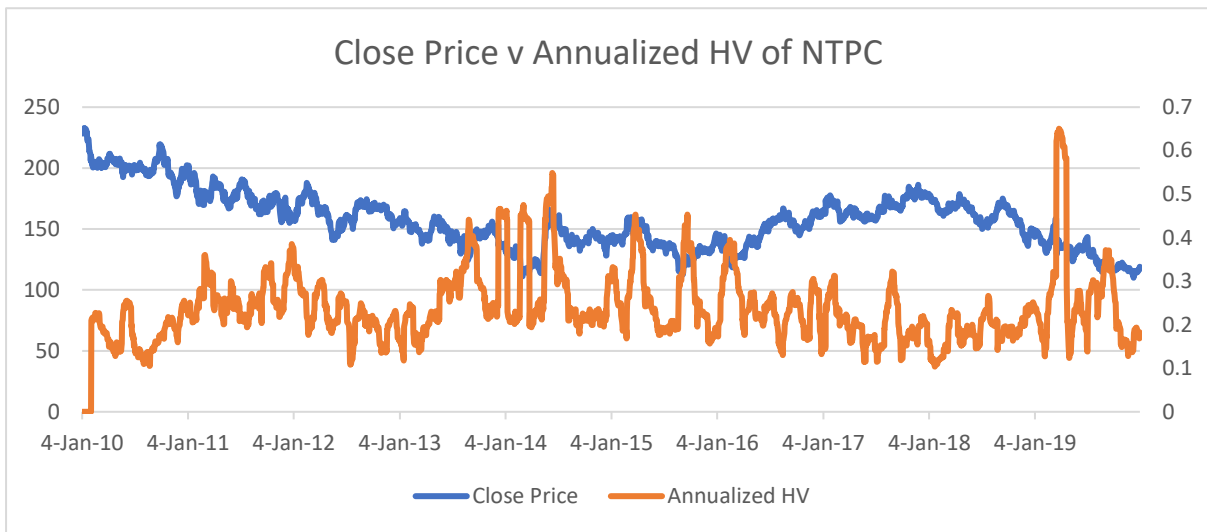
- **Data Collection:** All the data used during this program was sourced directly from the NSE's website i.e. www1.nseindia.com. The data used in derivative research is of option chain all the European call and put options' data for last 10 years of all the 3 firms was downloaded directly from the website and then used to complete the research work.

The screenshot shows the NSE website interface. At the top, there is a navigation bar with links for 'About Us', 'Investor Relations', 'Media', 'Circulars', 'Holidays', 'Regulations', and 'Contact Us'. Below this is a search bar with the text 'Search NSE'. The main content area features a navigation menu with 'Live Market', 'Products', 'Corporates', 'Membership', 'Domestic Investors', and 'International Investors'. The 'Products' menu is expanded, showing 'Equity Derivatives' and 'Historical Data'. The 'Historical Data' menu is further expanded to show 'Contract-wise Price Volume Archives'. The main content area displays the 'Historical Contract-wise Price Volume Data' form, which includes several dropdown menus for 'Select Instrument', 'Select Symbol', 'Select Year', 'Select Expiry', and 'Select Option Type'. There is also a text input field for 'Enter Strike Price'. Below these fields, there are radio buttons for 'For past: 1 Day' and 'Select a time period:'. A 'Get Data' button is located at the bottom of the form.

source: www1.nseindia.com

As can be seen above this portal helps us to find the historical prices of various scripts that are being traded on the NSE.

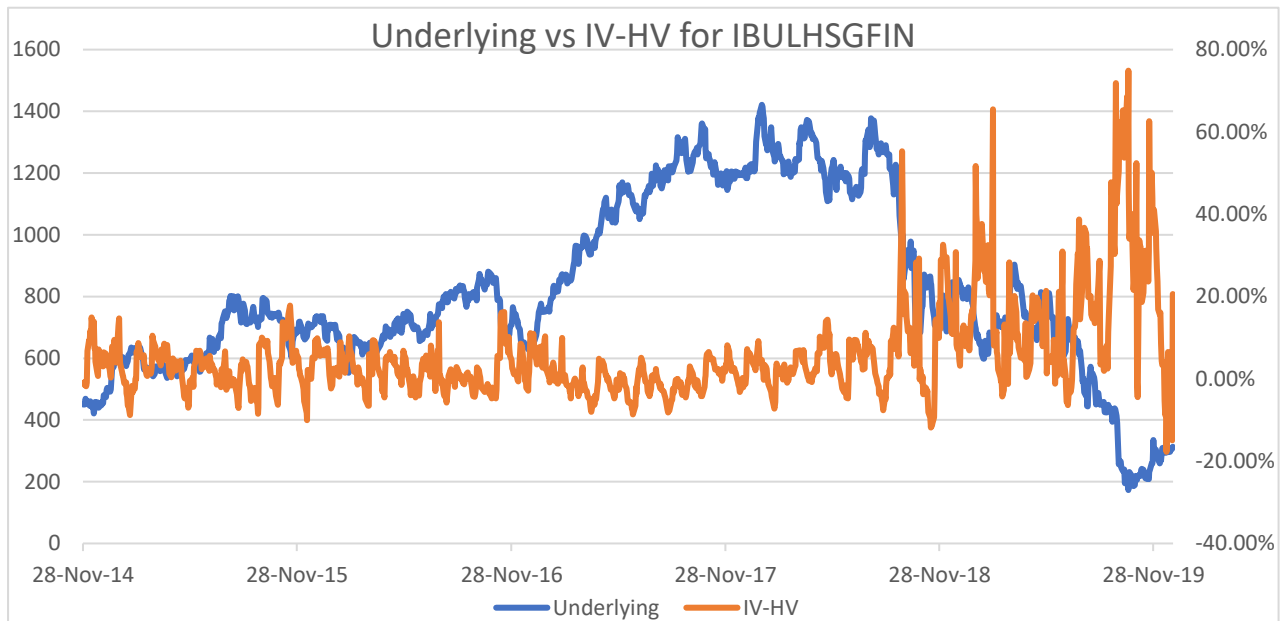
- **Data Manipulation:** After collection of required data, we manipulate the data to perform further task. We calculate annualized historical volatility(HV) for each script. Once the HV is calculated we find the IV by using VBA enabled Excel and then we compare both HV and IV to build our strategy.



The annualized HV is calculated by regressing the closed price of each day of the scripts with their next day and calculating its standard deviation over that month which is then used to calculate return over that year.

Next step is to calculate IV for both call and put options for last 10 years data. That is done by using the VBA enabled excel. This can also be found on internet but we chose to calculate it for each script to make our research more authentic.

Once both HV & IV are calculated we compare them both plotting the underline price against the difference of IV and HV to see whether the IV has any impact on underlying price on a particular day or not and can we form a strategy to buy or sell options on a particular IV levels to earn some profit.



Here we can see that for various IV levels underlying has reacted differently. Through this we can say that IV-HV levels does impact the underlying price and thus we can form our strategy to exploit this IV relation to maximize our returns.

- **Strategy formation:** At this stage we define our parameters to refine our strategy and try to find which are the optimal levels of IV are at which we can do trade to maximize our returns. In the above stated case of IBULHSGFIN we came to conclusion that it is better to trade at lower extreme of -4% and higher extreme of 15%. Meaning, whenever our IV-HV crosses these extremes we will do our trades accordingly. To calculate those trades, we will observe all the values which are falling in those extremes and then we will find the right strategy to implement.

In this case we chose to sell straddle at lower extreme when IV-HV is lower than their average value and buy straddle at higher extreme when IV-HV is higher than their average value.

Similarly, we form the strategy for other two scripts as well and came up with the following results:

For Lower extreme:

Rules:

Calculate the difference between IV and HV. Then choose higher and lower extremes and then observe those trades that fall under that spectrum.
 Take the trades as they cross the decided extremes and keep them till the expiry. Note: We're taking values for the given expiry month only.
 For NTPC, sell options as it hits the lower extreme.
 For NCC, sell options when IV & HV are greater than their respective averages at lower extreme.
 For IBULHSGFIN, sell options when IV-HV is less than their average value at lower extreme.
 Exit the trade if it crosses the S/L value in its due course towards expiry.

Trade Table:

	Trade Table			
	QTY	VOL	P/L	Brkg
Total Volume	866,400	5657040	1837200	18354
Max			101250	436
Min			-24720	46
Average			10439	104
# of Losing Trades			35	46
# of Winning Trades			130	130
Total # of Trades			165	176
% of Losing Trades			0.21	0.26
% of Winning Trades			0.79	0.74
Amount Lost in Losing Trades			-33,300.00	-36,958.00
Amount Gained in Winning Trades			718,650.00	715,695.30
Average Loss/Losing Trades			-951.43	-803.43
Average Gain/Wining Trades			5,528.08	5,505.35
Average Gain/Loss			5.81	6.85

From the above table we can observe that the proposed strategy gave us a Net Profit of INR 18,18,846 for last 10 years.

For Higher extreme:

Rules:

Calculate the difference between IV and HV. Then choose higher and lower extremes and then observe those trades that fall under that spectrum.
 Take the trades as they cross the decided extremes and keep them till the expiry. Note: We're taking values for the given expiry month only.
 For NTPC, buy options when IV and HV are lower then their respective average values at higher extreme.
 For NCC, buy options when IV and HV are lower then their respective average values at higher extreme.
 For IBULHSGFIN, buy options when IV-HV is less than their average value at higher extreme.
 Exit the trade if it crosses the S/L value in its due course towards expiry.

	Trade Table				
	QTY	VOL	P/L	Brkg	Net P/L
Total Volume	414,000	4285350	3216420	26226	3190194
Max			185850	666	185258
Min			-56250	41	-56404
Average			34327	202	24540
# of Losing Trades			65		65
# of Winning Trades			65		65
Total # of Trades			130		130
% of Losing Trades			0.50		0.50
% of Winning Trades			0.50		0.50
Amount Lost in Losing Trades			-564,300.00		-566,390.00
Amount Gained in Winning Trades			2,143,350.00		2,135,029.30
Average Loss/Losing Trades			-8,681.54		-8,713.69
Average Gain/Wining Trades			32,974.62		32,846.60
Average Gain/Loss			3.80		3.77

From the above table we can observe that the proposed strategy gave us a Net Profit of INR 31,90,194 for last 10 years.

Chapter 3

LITREATURE REVIEW

An equity derivative is a financial instrument whose value is based on equity movements of the underlying asset. For example, a stock option is an equity derivative, because its value is based on the price movements of the underlying stock. Investors can use equity derivatives to hedge the risk associated with taking long or short positions in stocks, or they can use them to speculate on the price movements of the underlying asset.

Other equity derivatives include stock index futures, equity index swaps, and convertible bonds. (Investopedia.com)

Options are financial instruments that are derivatives based on the value of underlying securities such as stocks. An options contract offers the buyer the opportunity to buy or sell—depending on the type of contract they hold—the underlying asset. Unlike futures, the holder is not required to buy or sell the asset if they choose not to.

Call options allow the holder to buy the asset at a stated price within a specific timeframe.

Put options allow the holder to sell the asset at a stated price within a specific timeframe.

Each option contract will have a specific expiration date by which the holder must exercise their option. The stated price on an option is known as the strike price. Options are typically bought and sold through online or retail brokers. (Investopedia.com)

There are 2 types of options that are European options and American options. In Indian market only European options are allowed to trade. The basic difference between European and American option is that in European option contract can not be terminated until the expiry date whereas in American options the contract can be terminated on or before expiry date.

As per work done during internship, I applied a lot of theory learned during the class sessions. I directly saw how options are traded in the market and what all is required to trade options in the Indian market. I also understood how the different types of option works i.e. call & put options. Further, what type of strategies are used by traders in the market.

Chapter 4

ORGANIZATION ANALYSIS AND EVALUATION

The organization I worked for i.e. The Money Roller is a small financial service company which operates in the financial services market and provide services like financial consulting, educating, mentoring, researching and report writing. It is based out of Mumbai, Maharashtra. It was founded by Mr. Rahul Ingle and Mr. Janak Shah both are MBAs and have a total of combined 20 years of financial market experience.

It is a small firm with 40 employees in total. It has an online portal TMRlive which provides various insights of Indian markets and what is going on in the economy at large. They run an online live project in equity and derivatives market throughout the year and provide opportunities to young minds to think like a financial analyst. It is a unique program as it provides young professional a sneak peek into the world of finance and at the same time help them leverage a new perspective of young professionals to their benefit. This program works as a catalyst which helps them tap the unknown potential of a young professional.

As per my experience this program is really helpful for young minds who are interested in building their career in the field of finance as it helps in understanding and doing things which are already being practiced in the industry by professionals. Not only it gives great insight into the financial markets but it also enables one to start investing in the markets as well.

4.1 Recommendations

The program is well constructed and really informative but there are few areas on which they can improve themselves. Some of these areas are:

- Increase the number of online sessions during the program.
- Try to incorporate the use of latest technologies like python, R, SAS etc.
- Regular checks on work progress should be done to ensure the quality of work.
- Try to incorporate the study/research on other instruments or products as well.

REFERENCES

Books:

- Financial Management by Prasanna Chandra
- The Intelligent Investor by Warren Buffett

Websites:

- Google.com
- Investopedia.com
- Nseindia.com
- TMRlive.com
- LinkedIn.com

ANNEXURE

Trade table was built by using the back-testing of manipulated data, below is the sample of a back-testing file:

Date	Scrip	Option Type	Entry	B/S	QTY	S/L	Exit	B/S	TO	Profit/Loss	Brokerage	Net P/L	Cumulative P/L
8-Sep-11	NCC	Call	3.95	S	9000	6.75	0.25	B	37800	33300	116	33184	33184
8-Sep-11	NCC	Put	0.55	S	9000	6.75	0.55	B	9900	0	60	-60	33125
9-Sep-11	NCC	Call	3.95	S	9000	6.75	0.25	B	37800	33300	116	33184	66309
9-Sep-11	NCC	Put	0.55	S	9000	6.75	0.55	B	9900	0	60	-60	66249
12-Sep-11	NCC	Call	2.75	S	9000	4.95	0.25	B	27000	22500	94	22406	88655
12-Sep-11	NCC	Put	0.55	S	9000	4.95	0.55	B	9900	0	60	-60	88595
13-Sep-11	NCC	Call	2.75	S	9000	4.95	0.25	B	27000	22500	94	22406	111001
13-Sep-11	NCC	Put	0.55	S	9000	4.95	0.55	B	9900	0	60	-60	110942
12-Sep-11	NCC	Call	2.75	S	9000	4.95	0.25	B	27000	22500	94	22406	133348
12-Sep-11	NCC	Put	0.55	S	9000	4.95	0.55	B	9900	0	60	-60	133288
17-Apr-12	NCC	Call	0.7	S	9000	17.55	0.1	B	7200	5400	54	5346	138633
17-Apr-12	NCC	Put	11	S	9000	17.55	11	B	198000	0	436	-436	138197
18-Apr-12	NCC	Call	2.35	S	9000	20.025	0.1	B	22050	20250	84	20166	158363
18-Apr-12	NCC	Put	11	S	9000	20.025	11	B	198000	0	436	-436	157927
19-Apr-12	NCC	Call	1.65	S	9000	18.975	0.1	B	15750	13950	72	13879	171806
19-Apr-12	NCC	Put	11	S	9000	18.975	11	B	198000	0	436	-436	171370
20-Apr-12	NCC	Call	0.9	S	9000	17.85	0.1	B	9000	7200	58	7142	178512
20-Apr-12	NCC	Put	11	S	9000	17.85	11	B	198000	0	436	-436	178076

Date	Scrip	Option Type	Entry	B/S	QTY	S/L	Exit	B/S	TO	Profit/Loss	Brokerage	Net P/L	Cumulative P/L
1-Jun-12	NCC	Call	2.1	B	9000	7.725	12.9	S	135000	97200	310	96890	96890
1-Jun-12	NCC	Put	3.05	B	9000	7.725	0.05	S	27900	-27000	96	-27096	69794
17-May-18	NCC	Call	4.8	B	9000	14.325	9.75	S	130950	44550	302	44248	114042
17-May-18	NCC	Put	4.75	B	9000	14.325	0.05	S	43200	-42300	126	-42426	71616
25-Jun-18	NCC	Call	1	B	9000	6.975	0.05	S	9450	-8550	59	-8609	63007
25-Jun-18	NCC	Put	3.65	B	9000	6.975	9.25	S	116100	50400	272	50128	113135
27-Jun-18	NCC	Call	0.3	B	9000	6.825	0.05	S	3150	-2250	46	-2296	110839
27-Jun-18	NCC	Put	4.25	B	9000	6.825	9.25	S	121500	45000	283	44717	155556
5-Sep-18	NCC	Call	6.3	B	9000	15.3	0.05	S	57150	-56250	154	-56404	99151
5-Sep-18	NCC	Put	3.9	B	9000	15.3	11.25	S	136350	66150	313	65837	164989
21-Sep-18	NCC	Call	2.1	B	9000	6.6	0.05	S	19350	-18450	79	-18529	146460
21-Sep-18	NCC	Put	2.3	B	9000	6.6	6.15	S	76050	34650	192	34458	180918
3-Jul-19	NCC	Call	3.55	B	9000	12.825	0.05	S	32400	-31500	105	-31605	149313
3-Jul-19	NCC	Put	5	B	9000	12.825	25.65	S	275850	185850	592	185258	334571
4-Jul-19	NCC	Call	3.3	B	9000	13.575	0.05	S	30150	-29250	100	-29350	305221
4-Jul-19	NCC	Put	5.75	B	9000	13.575	25.65	S	282600	179100	605	178495	483716
5-Jul-19	NCC	Call	4.25	B	9000	11.55	0.05	S	38700	-37800	117	-37917	445798
5-Jul-19	NCC	Put	3.45	B	9000	11.55	21.3	S	222750	160650	486	160165	605963

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