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Portfolio Optimization for CNX IT (NSE) on the Basis of an Event Study

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Abstract:
Portfolio Optimization involves financial assets. Identifying an optimum portfolio requires the investors to understand the various financial instruments that constitute the financial assets. These instruments operate in market asymmetry. It is operated by the investors and borrowers. In general; the companies belong to borrowing sector while the individuals are presumed to be the lenders of money. This financial commitment is represented and explained in the Balance Sheet data. Market is a sensitive space. Any and every second it operates as a dynamic hot seat for the lenders and borrowers. On a public event date such as the 2014 Election date for Chennai (i.e. April 24) the implication of it is sought for in the immediate weeks – before and after. How the investors and markets react? What expressions do they use? The social media provides a plethora of information for analysing the market trend. One can either use data mining or use textual mining for capturing the mood of the market. The textual mining is done using data collected from twitter using R Studio. The focus sector is NSE – IT sector. As most of the IT industry's companies are based out of the country, an analysis on the behavioural impact is studied on the portfolio of stocks held; to identify the best stocks to buy, hold or sell – which would pave the way to achieving the objective of maximizing returns, minimizing risk or both.

1. Introduction

Today, technology rules the world. There is no space in earth where some form of technology has not yet touched. It is not very uncommon for a kid these days to unlock a mobile device, or an I-pad to play games and/or listen to educational materials. A middle and high school student has question banks to prepare for exams. A college student uses it to browse content and gather a plethora of information from the internet. The corporate world often uses something called "information technology", which is a more refined and specialized form of technology; to communicate with its various stakeholders. Information Technology is mainly driven by the internet. The many softwares, along with the Internet 2.0 helps to create a connected world which makes the life easier. Any organization needs finance to function. Therefore, it is understood that every organization has a relationship with at least one of the financial organizations and hence, is a part of the banking activities. Thus, all organizations and individuals are connected – either directly or indirectly – through IT with finance, which in turn, is affected by the turn of events in stock markets on a regular basis.

Portfolio optimization is the process of choosing the proportions of various assets to be held in a portfolio, in such a way that the portfolio is better than any other according to some criterion.

The criterion will combine, directly or indirectly, considerations of:

1. the expected value of the portfolio's rate of return
2. the return's dispersion and
3. possibly other measures of financial risk

We need to know who the major players in IT industry are. How to create an optimized portfolio with them? What is the Index that governs them? This is the curiosity upon which I have chosen to research on the IT industry in the financial domain for internship.

The list of top 10 companies in the IT industry – by their weightage is as follows:

Company's Name	Weight (%)
Infosys Ltd	39.19
Tata Consultancy Services Ltd	26.97
HCL Technologies Ltd	9.2
Wipro Ltd	8.78
Tech Mahindra Ltd	6.59
Oracle Financial Services Software Ltd	1.61
MindTree Ltd	0.99
Vakrangee Ltd	0.77
Info Edge (India) Ltd	0.76
MphasiS Ltd	0.73

Table 1: Table of Top 10 IT companies by their weightage

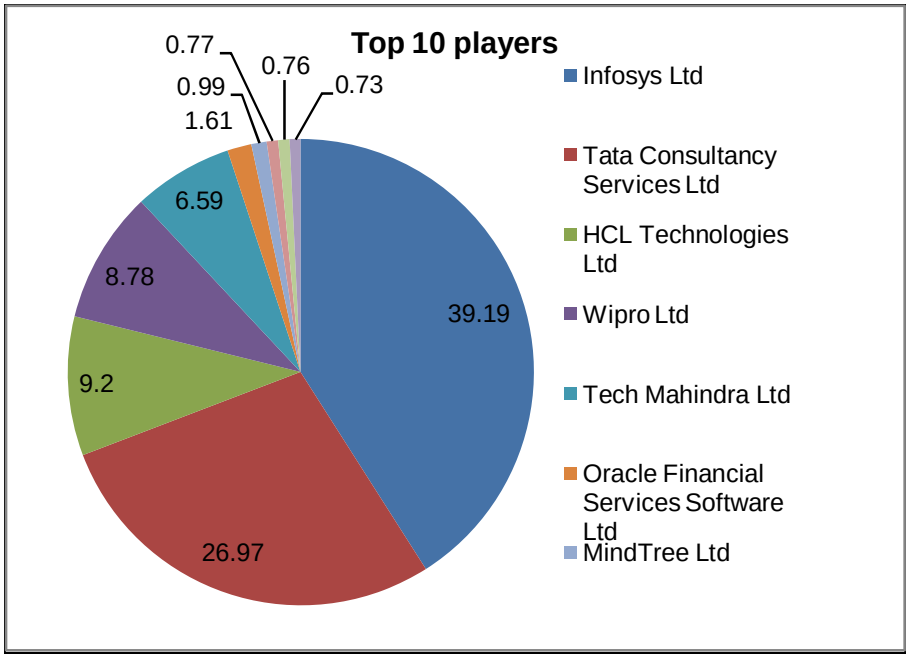

Figure 1 :Chart of Top 10 IT companies on the basis of their weightage
Note: Weightage rounded off to nearest whole number for pictorial representation

1.1. Thus the Objective of This Study Is to

1. to analyze the stock market sentiments in it sector and their behavior from twitter tweets during the specific event period
2. to examine the variations and any abnormal return in stocks of the various it companies on account of happening of the specified event
3. to identify the internal and external factors that contributes primarily towards the occurrence of the specified event

2. Literature Review

Grewal S.S and Navjot Grewall[1] (1984) revealed some basic investment rules and rules for selling shares. They warned the investors not to buy unlisted shares, as Stock Exchanges do not permit trading in unlisted shares. Another rule that they specify is not to buy inactive shares, ie, shares in which transactions take place rarely. The main reason why shares are inactive is because there are no buyers for them. They are mostly shares of companies, which are not doing well. A third rule according to them is not to buy shares in closely-held companies because these shares tend to be less active than those of widely held ones since they have a fewer number of shareholders. They caution not to hold the shares for a long period, expecting a high price, but to sell whenever one earns a reasonable reward.

David. L. Scott and William Edward[2] (1990) reviewed the important risks of owning common stocks and the ways to minimize these risks. They commented that the severity of financial risk depends on how heavily a business relies on debt. Financial risk is relatively easy to minimize if an investor sticks to the common stocks of companies that employ small amounts of debt. They suggested that a relatively easy way to ensure some degree of liquidity is to restrict investment in stocks having a history of adequate trading volume. Investors concerned about business risk can reduce it by selecting common stocks of firms that are diversified in several unrelated industries.

L.C.Gupta[3] (1992) revealed the findings of his study that there is existence of wild speculation in the Indian stock market. The over speculative character of the Indian stock market is reflected in extremely high concentration of the market activity in a handful of shares to the neglect of the remaining shares and absolutely high trading velocities of the speculative counters. He opined that, short- term speculation, if excessive, could lead to "artificial price". An artificial price is one which is not justified by prospective earnings, dividends, financial strength and assets or which is brought about by speculators through rumours, manipulations, etc. He concluded that such artificial prices are bound to crash sometime or other as history has repeated and proved.

Donald E Fischer and Ronald J. Jordan[4] (1994) analyzed the relation between risk, investor preferences and investor behaviour. The risk return measures on portfolios are the main determinants of an investor's attitude towards them. Most investors seek more return for additional risk assumed. The conservative investor requires large increase in return for assuming small increases in risk. The more aggressive investor will accept smaller increases in return for large increases in risk. They concluded that the psychology of the stock market is based on how investors form judgement about uncertain future events and how they react to this judgement.

Avijit Banerjee[5] (1998) reviewed Fundamental Analysis and Technical Analysis to analyze the worthiness of the individual securities needed to be acquired for portfolio construction. The Fundamental Analysis aims to compare the Intrinsic Value (I.V) with the prevailing market price (M.P) and to take decisions whether to buy, sell or hold the investments. The fundamentals of the economy, industry and company determine the value of a security. If the I.V is greater than the M.P., the stock is under-priced and should be purchased. He observed that the Fundamental Analysis could never forecast the M.P. of a stock at any particular point of time. Technical Analysis removes this weakness. Technical Analysis detects the most appropriate time to buy or sell the stock. It aims to avoid the pitfalls of wrong timing in the investment decisions. He also stated that the modern portfolio literature suggests 'beta' value p as the most acceptable measure of risk of scrip. The securities having low P should be selected for constructing a portfolio in order to minimize the risks.

Seema Shukla[6] (1999) disclosed the changing face of risk by comparing the old paradigm and the new paradigm. The old paradigm is that risk assessment is an AD-HOC activity that is done whenever managers believe there is a need to do it. But the new paradigm is that risk assessment is a continuous activity. The old pattern of risk management was to inspect and detect business risk and then react. But the new pattern is to anticipate and prevent business risk at the source and then monitor business risk controls continuously. She distinguished between business risks and financial risks. In managing the business risk, one looks at the risk reward profile to maximize reward based on the risk appetite. She opined that one can run a business by minimizing financial risk, but the business risk itself could be high. She clears the air by stating that business risk is technology risk, political risk, geography risk, the changing preference of customers, economic risk, etc. whereas financial risk is currency risk, interest rate risk, commodities risk etc. To manage these risks, the first step is to identify the risks and determine the source of those risks. There is no way to manage something that cannot be measured, so the next step involves getting a measure of the significance and likelihood of occurrence. She concluded by emphasizing the need to prioritize the risks, as it is impossible to throw resources on all kinds of risks.

Gerela. S. T. and Balsara.K.A.[7] (2001) reviewed the risk management system at the Bombay Stock Exchange. They reported that the BSE has strengthened the risk management measures to maintain the market integrity. The introduction of the modified carry forward system, coupled with the BOLT (Bombay Online Trade) expansion to cities all over India has led to a significant increase in the liquidity and volumes at the exchange. As a consequence, the risk management function at the BSE has assumed greater importance. In order to maintain the market integrity and to avert payment defaults by the members, the exchange has strengthened its risk management system by taking the following measures:

1. All members are required to maintain the base minimum capital of Rs.10 lakh with the exchange.
2. As a risk management measure the exchange places trading restrictions on the members.
3. The exchange has prescribed a ceiling on the gross exposure of the members.
4. The exchange collects from the members, daily margin, additional volatility margin, incremental carry forward margin, etc.
5. The exchange has constituted a risk management committee to put in place a long-term risk management policy.

Rukmani Viswanath[8] (2001) reported that the Primary Dealers in Govt. securities are working on a new internal risk management model suited for the Indian market conditions. The attempt is to lay down general parameters for risk perception. The Primary Dealers Association of India (PDAI) is formulating a set of prudential norms for 'risk management practices'. While internationally the principles of risk management may be the same everywhere, the Association is of the view that they have to identify the relevant issues and apply those principles in the Indian context. It strongly argues that it must work on a model that can help to manage liquidity and interest rate risk. While the existing RBI guidelines on risk management cover mainly statutory risk, the PDAI hopes that its new risk management model will be able to perceive 'real risk'. These new norms are expected to help gauge several issues like, whether a fall in the prices of securities or yields is a temporary or permanent situation etc. The areas the new norms are likely to address are the assessment of the liquidity situation and envisaging investor appetite for a specific instrument and their appetite for risk. According to the govt. securities dealers, these norms are expected to help them hedge their risks better. The primary dealers are looking forward to these norms to help them manage their internal risks.

2.1. Twitter Analysis Based Literature Review

Bollen & Mao[9] (2009) study analyzed the public's emotional state over a month period by using a term based emotional rating system known as "Profile of Mood States (POMS)". Sentimental analysis is performed for all public tweets broadcasted by twitter users between Aug 1 and Dec 20 2008. The results were compared to fluctuations recorded b stock market and crude oil price

indices and major events in media. The results fund that the events in the social, cultural and economic sphere do have a significant, immediate and highly specific effect on the various dimensions of public mood.

Mao & Bollen[10] (2009) developed a simple and direct indicator of online investment which was extracted from twitter updates and Google search queries. The study examined the predictive power of this new investor bullishness indicator on international stock markets. The study compared Twitter and Google bullishness to stock market values across four different countries using granger causality test. The results indicated that changes in twitter bullishness predict changes in Google bullishness which indicated that twitter information precedes Google queries. The study also found that high twitter bullishness predicts the increase of stock returns.

Bollen, Mao & Zheng[11] (2010) investigated whether the measurement of collective mood states derived from large scale twitter feeds were correlated to the value of DJIA overtime. The study used opinion finder and GPOMS to measure variations in the public mood from tweets submitted to the twitter service from Feb to Dec 2008. Granger Causality analyses were used to correlate DJIA values to GPOMS & OF values for the past n days. Next the study used self-organizing fuzzy neural network model to test the hypothesis that the prediction accuracy of DJIA prediction models using measurements of public mood. A correlation of mood time series was drawn between GPOMS and OF and was found that certain mood dimensions of GPOMS partially overlap with OF.

Zhnag, Fuehres & Gloor[12] (2011) tried to predict stock market indicators such as DowJones, NASDAQ & S&P500 by analyzing twitter posts. They analyzed the positive and negative moods of the masses of twitter for a period of 6 months and compared it with stock market indices. The study investigated the emotions of the tweets under three different baselines: number of tweets per day, number of followers per day and number of re-tweets per day. The study correlated the ratio of emotions with the indices returns for the day t+1. The results were surprising as it found that people start using emotional words such as 'hope', 'fear' and 'worry' in times of economic uncertainty, independent of whether they have a positive or a negative context. Thus when the emotions on twitter is high, the Dow goes down the next day and when people have less hope, fear and worry Dow goes up.

Measuring abnormal returns for firms on a particular event like elections, acquisitions, mergers and dissolution, and so on has been an interesting area of study to researchers in India and abroad (Chatterji & Kuenzi, 2010; Rani, Neelam & Yadav, 2013). The most common measure of abnormal returns across the globe is the event study methodology. It measures the returns for specific periods of time. The abnormal returns for a particular event may be due to various reasons such as the information asymmetry and rumours that spread across the market about that event. With the current technology developed during the recent years, the social media has emerged as one of the most powerful medium of information dispersion. Researchers have tried to capture the use of social media and its information in predicting events such as volcanic eruptions, election results, and pattern of financial crises and so on. Thus; prediction of events and results from social media is becoming a field for attractive research area to researchers across the world.

The recent improvement in this field is capturing the sentiments of investors through social media and predicting the stock market behaviour using the investor sentiments. Twitter is one of the social media which is in high esteem in the financial community. Messages (tweets) from twitter can be easily accessed through application programming interface (API). Many sub forums in twitter has been started recently like Stocktwits and TweetTrader which acts as a platform for discussion among the investors. Researchers have tried to capture the stock market behaviour using the investor sentiments derived from tweets using Google Profile of Mood States, Opinion Finder and so on (Bollen & Mao, 2009; Zhang & Gloor, 2011; Rao & Srinivasta, 2013).

3. Research Gap

The review of literature reveals that recently no study has been undertaken in Kerala on risk management in investment in corporate securities. Scholars have contributed much to the theories related to risks like risk return relationship, expected value, risk and uncertainty, attitude towards risk, EVA (Economic Value Added) etc. But there is lack of studies on the objectives behind investment in corporate securities, the types of shares that the investors like to invest in, the precautions they take against risks, how they manage a crisis while operating in securities market, the gender differences in handling risks, etc.

The review of literature has brought to light that there exists wild speculation in Indian stock markets, but whether speculation leads to diverting funds from the stock market or not raises a big question mark. There are theories like the Fundamental analysis, Technical analysis etc. to evaluate the securities. To what extent these theories are applied is another question to be resolved. Keeping in mind, these unresolved, inadequately explained and insufficiently explored issues the present study has been undertaken. This study takes a different stand from literature as it studies the influence of twitter sentiments on the abnormal returns of firms on a particular event. Unlike the literature which predicts the stock behaviour of tomorrow using today's tweets, this study, studies the influence of twitter tweets around the event announcement on the abnormal returns and cumulative abnormal returns around the announcement.

The event considered in this study is the Lok Sabha voting date in Chennai – April 24th, 2014.

4. Methods and Materials

4.1. Hypothesis

- H_0: There is no significant impact of Lok Sabha voting on the share market prices.
- H_1: There is a significant relationship between date of Chennai Lok Sabha voting (2014) and stock market.
- H_2: There is a significant change in the abnormal return of companies.

4.2. Sample selection

A list of 20 companies belonging to NSE CNX IT Index was selected for the study.
The companies selected were expected to meet the below requirements:

- The companies should be listed in National Stock Exchange (NSE)
- The companies should have market data for (-10, +10) days around the specified announcement.
- The company must be established in twitter space

4.3. Twitter Sentimental Analysis

Tweets were collected for the 20 companies in the sample for the chosen event. As a developing economy, tweets for Indian companies will be comparatively less when compared to the companies in the developed economies.
The number of tweets collected for each company is shown below:

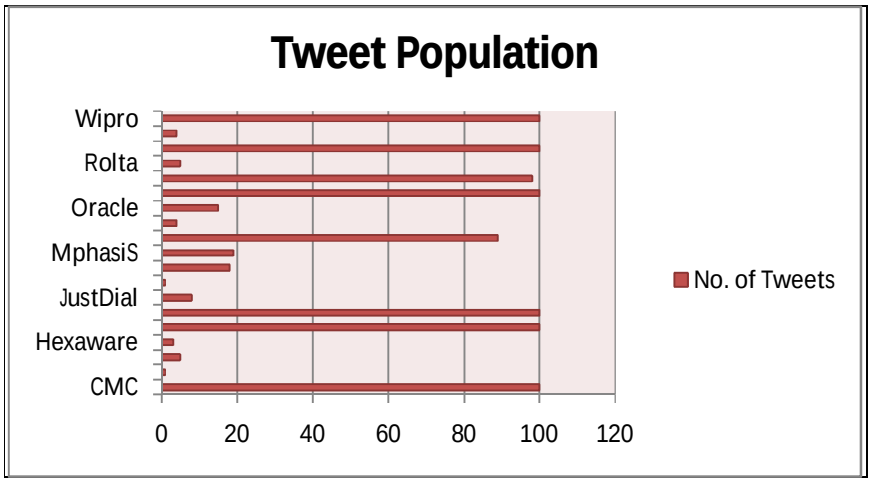

Figure 2 :Bar Chart of Number of Tweets per company

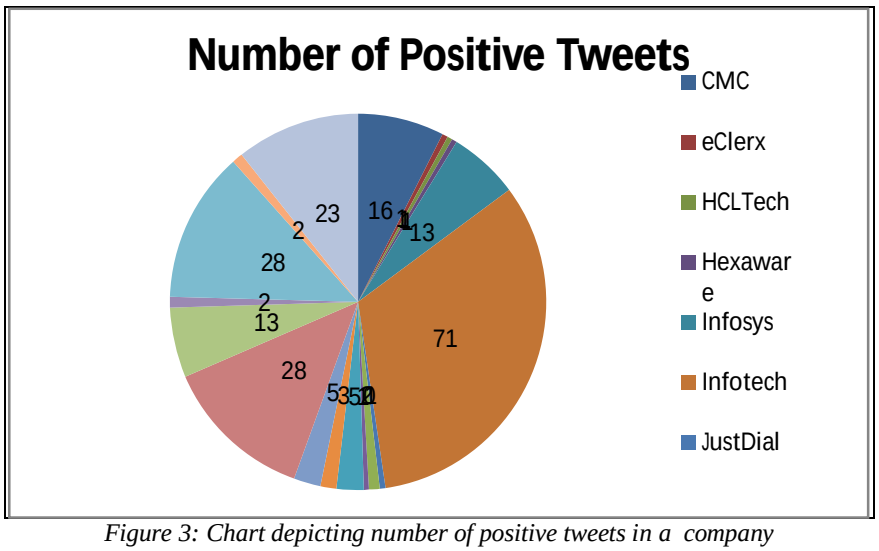

Figure 3: Chart depicting number of positive tweets in a company

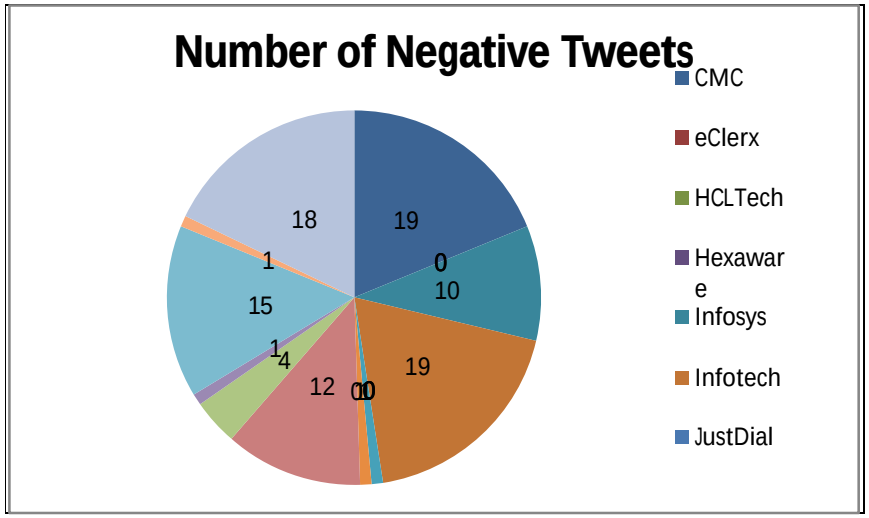

Figure 4 : Chart depicting number of negative tweets in a company

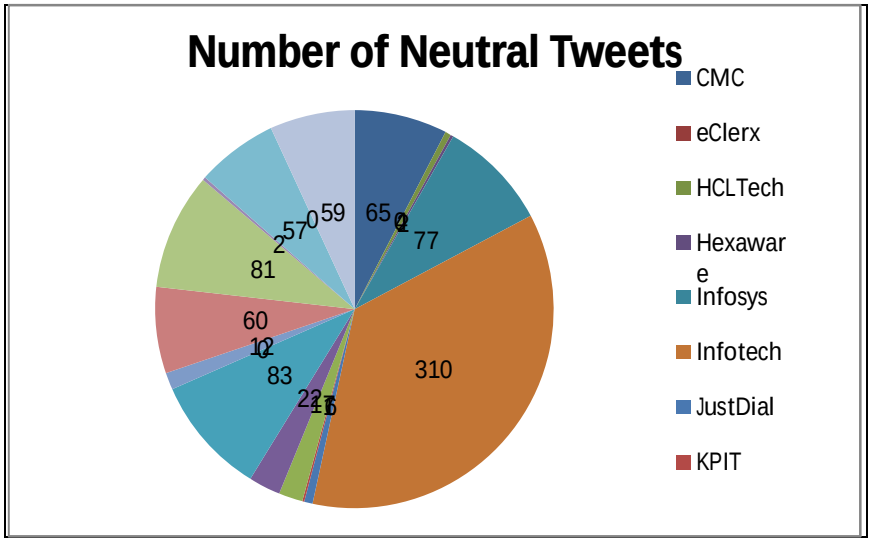

Figure 5 : Chart depicting number of neutral tweets in a company

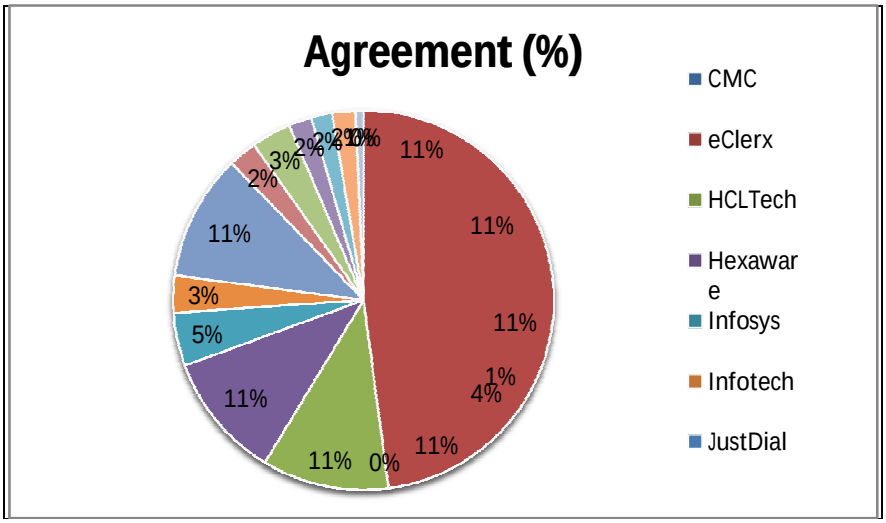

Figure 6 : Chart depicting percentage of agreement

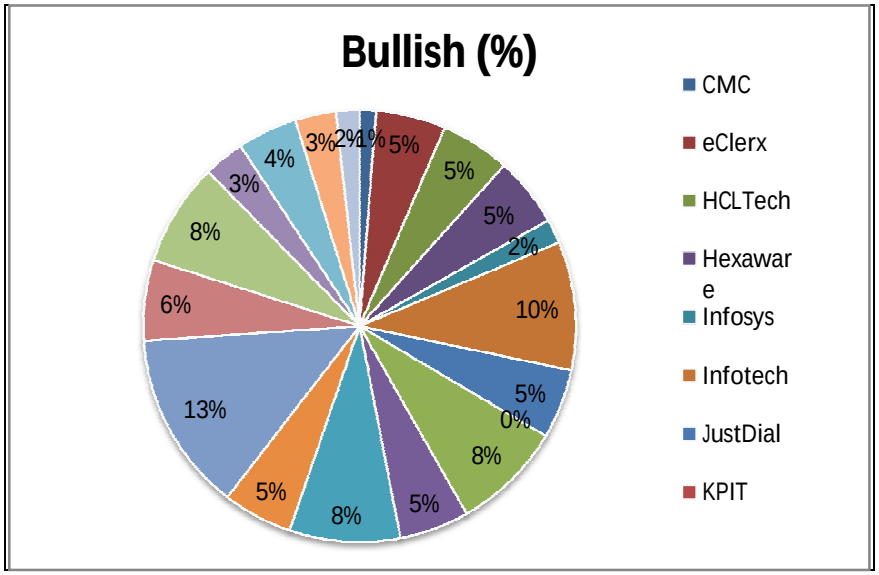

Figure 7 : Chart depicting percentage of bullishness

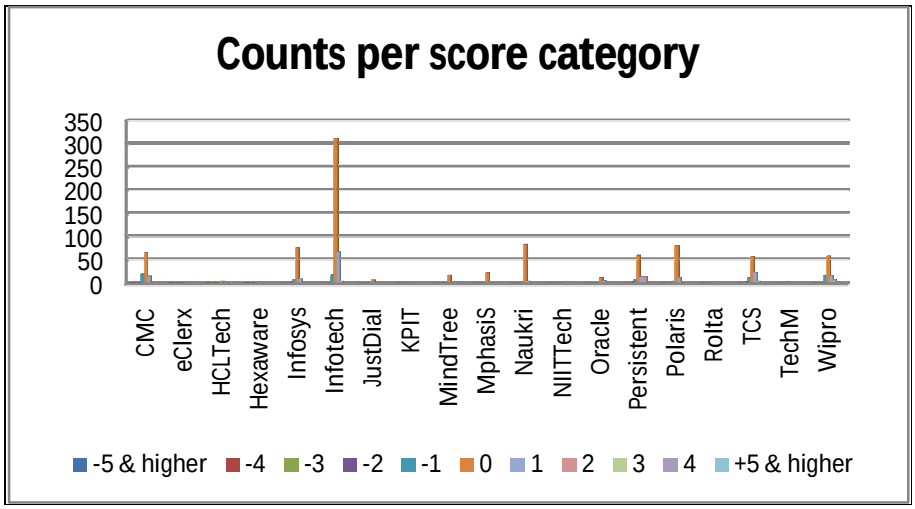

Figure 8 : Chart indicating the counts per score category

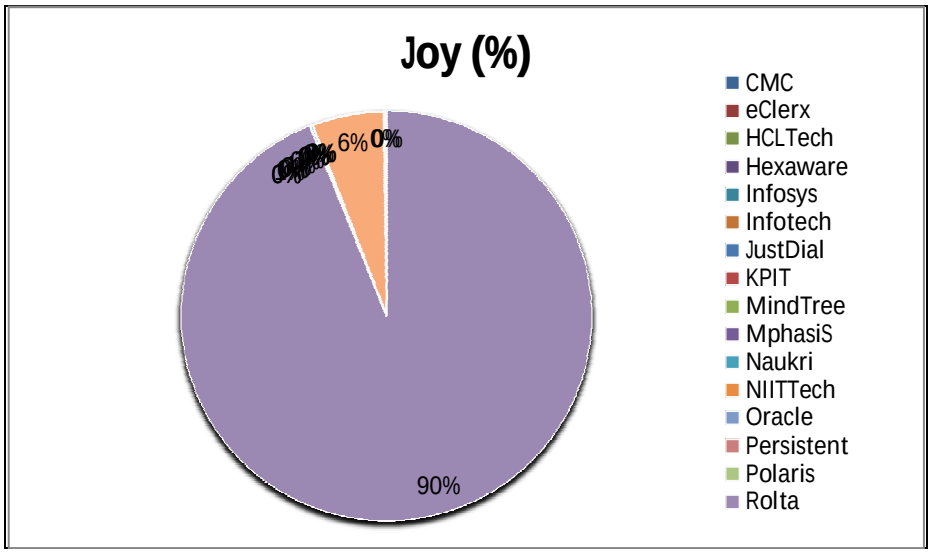

Figure 9 : Chart indicating the percentage of joy

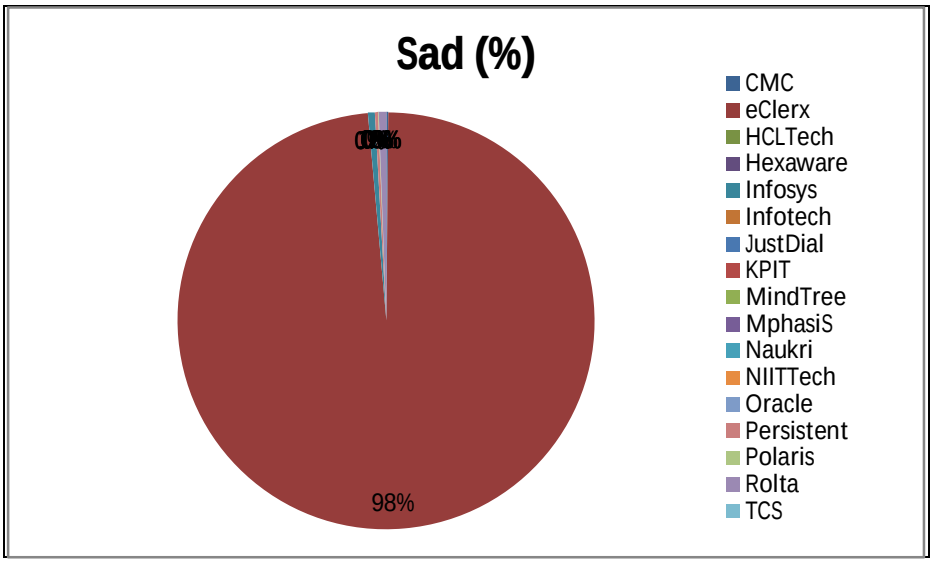

Figure 10 : Chart indicating the percentage of sadness

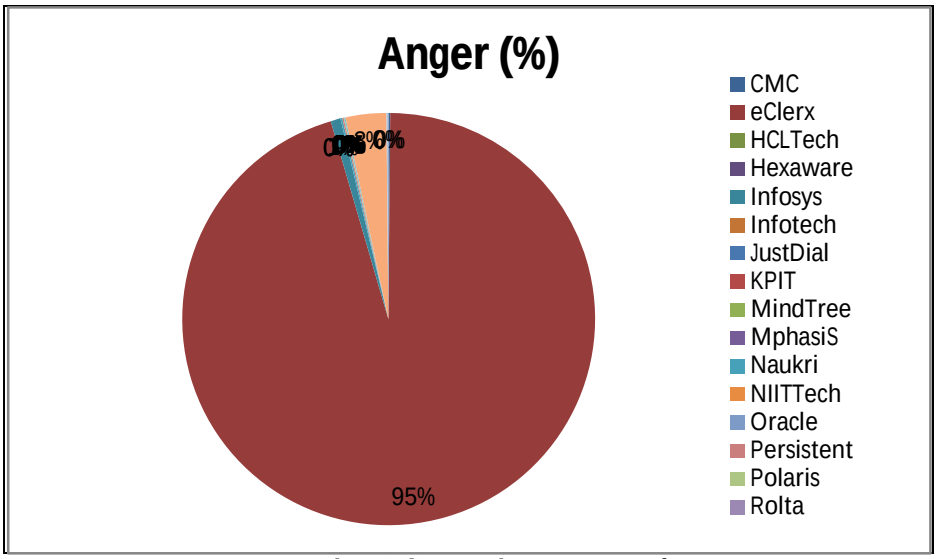

Figure 11:Chart indicating the percentage of anger

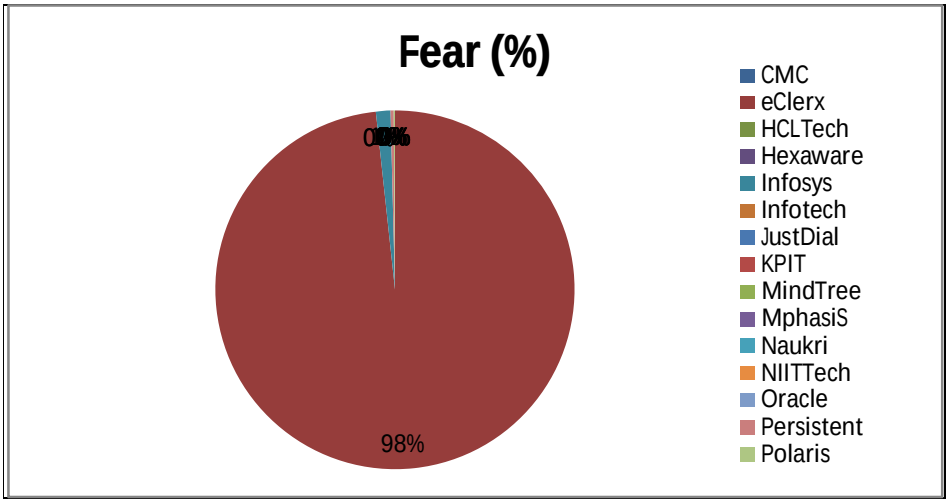

Figure 12 : Chart indicating the percentage of fear

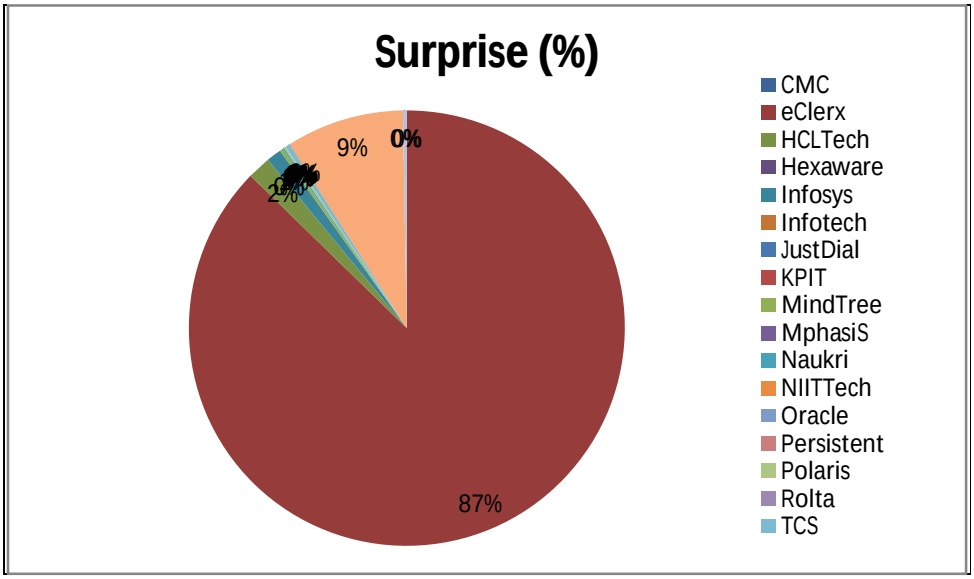

Figure 13 : Chart indicating the percentage of surprise

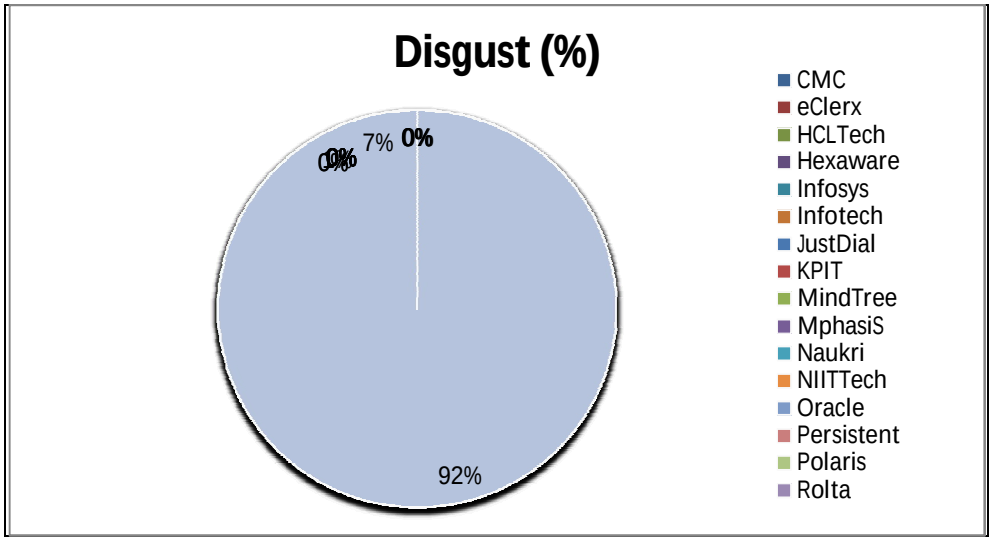

Figure 14 : Chart indicating the percentage of disgust

The various tweets were collected by using an API authentication for each company. The collected tweets were subjected to sentimental analysis through R-Studio. The tweets were imported into R-Studio and the emotion and polarity of tweets for each company were computed. R-Studio is data mining software which analyzes the tweets and categorizes their emotion and polarity using various codes. The tweets collected for each company were imported into R-studio which upon the execution of codes gave the polarity (positive and negative) and emotion (sad, fear, anger, disgust, surprise and anger) for the tweets of each company.
Each company's polarity and emotion were thus classified separately using R-studio. The emotions were then computed as ratios or percentage. From Zhang, Fuehres & Gloor (2011) and Bollen & Mao (2010) the percentage of emotion and polarity is computed as follows:

(1) Bullishness : $B_t = \ln\left(\frac{1 + M_t^{positive}}{1 + M_t^{negative}}\right)$

(2)Agreement : $A_t = 1 - \sqrt{1 - \frac{M_t^{positive} - M_t^{negative}}{M_t^{positive} + M_t^{negative}}}$

(3) Positive% = (total positive tweets) / (total number of tweets)
(4) Negative% = (total negative tweets) / (total number of tweets)
(5) Joy% = (total joy tweets) / (total number of tweets)
(6) Sad% = (total sad tweets) / (total number of tweets)
(7) Fear% = (total fear tweets) / (total number of tweets)
(8) Anger% = (total anger tweets) / (total number of tweets)

4.4. Classification by Emotions

The following image depicts the classification by emotions.

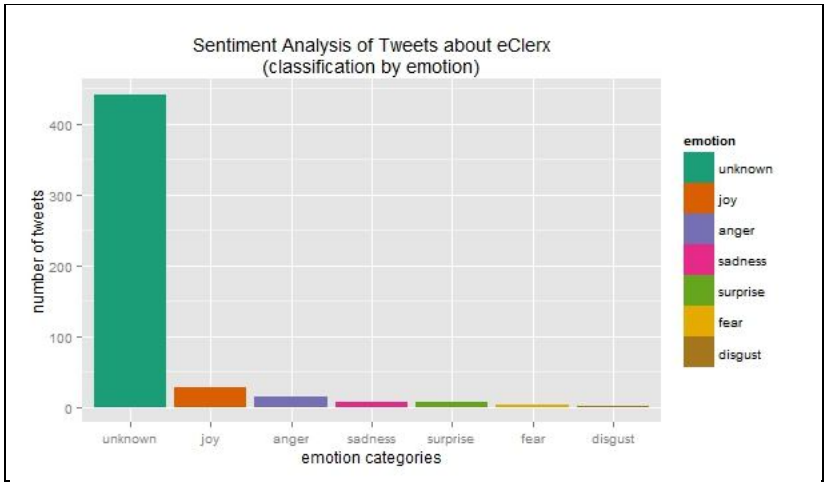

Figure 15 : Chart indicating the classification by emotion

4.5. Classification by Polarity

The below image indicates classification by polarity.

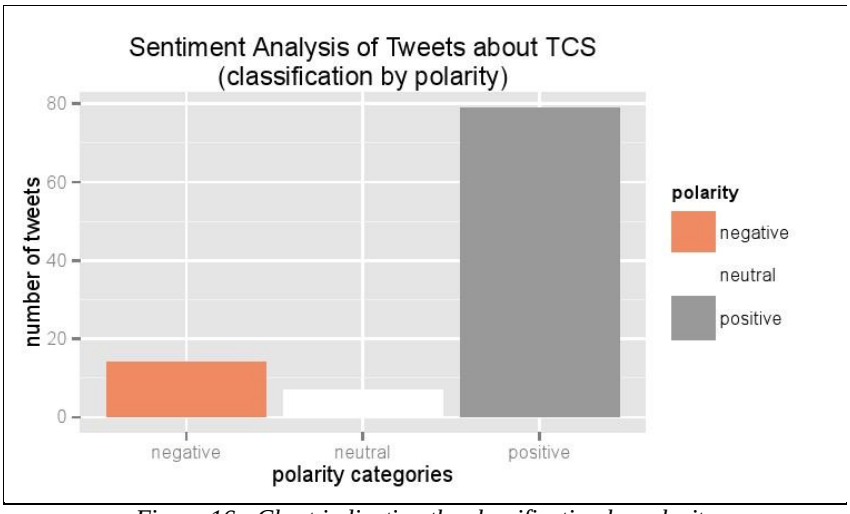

Figure 16 : Chart indicating the classification by polarity

4.6. Event Study Methodology

To collect and calculate the abnormal returns of the companies, event study methodology is used. Abnormal returns and cumulative abnormal returns were collected for 10 days around the voting date announcement.

This study uses a short-term event window of the estimation period -10 to +10 days around the announcement period. The CAR (Cumulative Abnormal Returns) is observed for (-10, +10) days around the announcement.

Brown and Warner (1985) presented various measures in an event study methodology to test for excess returns. They were:

- β Mean adjusted returns,
- β Market adjusted returns and
- β Ordinary Least Square market model

This study adopts the Market model for calculating the abnormal returns from Chatterji & Kuenzi (2001) for its popularity in the literature.

4.6.1. The market model of Chatterji & Kuenzi, 2001

The Cumulative Abnormal Returns are calculated using:

$$\mathbf{CAR}_{(t,T)} = \sum_t^T \mathbf{ARt}$$

ARt = average abnormal return on day t;

t, T = Accumulation period

Examining the CAR of a set of sample securities will be used to look at whether or not the values of the average residuals, starting from the day of accumulation and up to a specific point, are systematically different from zero [Chatterji & Kuenzi (2001)].

4.7. Multiple Regression Analysis

To finally examine the influence of twitter sentimental analysis on CAAR, the multiple regression analysis is used. The regression function is of the form:

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots. + \beta_N X_N + \varepsilon}$$

Where $\beta_0, \beta_1, \beta_2 \ldots \beta_N$= are constants called the model regression co-efficient or parameters, which means the regression scores identified statistically for the variables that have a significant level as .000.

$X_1 + X_2 + X_3 + \ldots\ldots X_N$ **= are** the predictor variables in this study.

Y = will be the response variable or dependent variable that substitutes for acquirer decision. It is a quantitative data.

E = randomized disturbance or error.

Regression computes the regression co-efficient β_j while the independent or predictor variables are the actual values that are in the variables. Where j = 1, 2….n.

4.8. Variable Selection

The variables used in the study are the twitter parameters of emotion and polarity and CAR for each company. The variables for the twitter parameters were calculated from Zhang, Fuehres & Gloor (2011) and Bollen & Mao (2010) and CAR were computed following Chatterji & Kuenzi (2010) and Warner & Brown (1985). The table *[3.6.1]* below shows the list of variables used in the study.

Variables	Explanation
	Binary Variables
Face Value	The amount of money stated on a stock or a bond certificate.
Dividend Per Share	Dividend per share (DPS) is the total dividends paid out over an entire year (including interim dividends but not including special dividends) divided by the number of outstanding
Operating Profit Per Share	Operating profit / earnings per share is defined as net operating earnings divided by the weighted average number of fully diluted shares outstanding for the period.
Net Operating Profit Per Share	A company's operating income after operating expenses are deducted, but before income taxes and interest is deducted. If this is a positive value, it is referred to as net operating and dividing it by total shares give net operating profit per share
Bonus in Equity Capital	A bonus share is a free share of stock given to current shareholders in a company, based upon the number of shares that the shareholder already owns.
Interest Cover	A ratio used to determine how easily a company can pay interest on outstanding debt. The interest coverage ratio is calculated by dividing a company's earnings before interest and taxes (EBIT) of one period by the company's interest expenses in the same period
Adjusted Cash Margin	A measure of the money a company generates from its core operations per dollar of sales.
Net Profit Margin	Net profit margin is the percentage of revenue remaining after all operating expenses, interest, taxes and preferred stock dividends (but not common stock dividends) have been
Return on Long Term Fund	Long term funds use leverage, derivatives and short positions in an attempt to maximize total returns, regardless of market conditions.
Return on Net Worth	The amount of net income returned as a percentage of shareholders equity. Return on equity measures a corporation's profitability by revealing how much profit a company
Adjusted Return on Net Worth	A method for valuing an insurance company using capital values, surplus values, and an estimated value for business on the company's books
Return on Assets Excluding Revaluations	This identifies the return derived from assets to understand whether the assets of the management are utilized fully or in sub-optimal capacity.
Total Assets Turnover Ratio	The amount of sales or revenues generated per dollar of assets. The Asset Turnover ratio is an indicator of the efficiency with which a company is deploying its assets.
Total Debt to Owners Fund	A measurement of a company's financial leverage, calculated as the company's debt divided by its total capital. Debt includes all short-term and long-term obligations.
Financial Charges Coverage Ratio Post Tax	A measure of a firm's ability to meet its fixed-charge obligations: the ratio of (Earnings before interest, depreciation and amortization minus unfunded capital expenditures and distributions) divided by total debt service (annual principal and interest payments).
Dividend Payout Ratio Cash	The fraction of net income a firm pays to its stockholders in dividends.

Profit	
Earning Retention Ratio	The proportion of earnings kept back in the business as retained earnings.
Adjusted Cash Flow Times	A financial ratio commonly used in the analysis of oil companies, representing the after-tax operating cash flow, excluding financial expenses after taxes.
Earnings Per Share	EPS is the portion of a company's profit allocated to each outstanding share of common stock.
Book Value	The value at which an asset is carried on a balance sheet. To calculate, take the cost of an asset minus the accumulated depreciation.
Bullishness	A financial market of a group of securities in which prices are rising or are expected to rise. The term "bull market" is most often used to refer to the stock market.
Agreement	The agreement is the proportion of positive and negative feelings in the market on Chennai Voting date – April, 2014
Emotions (Joy / Sad / Anger / Disgust / Surprise / Fear)	These variables represent the various emotions of tweets around the Chennai Voting date – April, 2014
Positive	This represents the percentage of positive feeling in the market due to acquisition announcement.
Negative	This represents the percentage of negative feeling in the market due to acquisition announcement.
	Dependent Variable
CAR 5	Sum of the differences between the expected return on a stock and the actual return often used to evaluate the impact of news on a stock price. Cumulative Abnormal Returns for 20 days around the voting date announcement (10 days prior and 10 days hence Voting)

Table 2

5. Analysis and Results

5.1. Regression Results

From univariate analysis, the study now focuses on a multivariate analysis. Regression includes variables that are specified above in table. Regression results are summarized in the table below:

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.996[a]	.993	.932	2.06688

Table 3 : Table indicating model fit of regression

The above table (3) indicates the level of fitness of the model regression model. The result is considered well fit if there is more than 80% in the R value. The above result indicates that there is a minimum of 99% model-fit.

ANOVA [a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	1178.925	17	69.349	16.233	.060[b]
	Residual	8.544	2	4.272		
	Total	1187.469	19			

Table 4 : Table of Anova

Dependent Variable[a]: CAAR (-5+5)

Predictors		**Beta**	**t**	**Sig.**
1	(Constant)		-3.861	.061
	Operating Profit Per Share	-4.069	-4.620	.044
	Net Operating Profit Per Share	-3.288	-3.206	.085
	Bonus in Equity Capital	-.356	-2.745	.111
	Interest Cover	-8.499	-3.247	.083
	Adjusted Cash Margin	4.525	5.466	.032
	Net Profit Margin	-13.904	-4.701	.042
	Return on Long Term Fund	10.699	3.764	.064
	Return on Net Worth	7.020	5.088	.037

	Adjusted Return on Net Worth	-12.618	-4.113	.054
	Return on Assets Excluding Revaluations	3.141	4.510	.046
	Total Assets Turnover Ratio	-.667	-3.095	.090
	Total Debt to Owners Fund	-5.680	-4.175	.053
	Financial Charges Coverage Ratio Post Tax	7.537	2.895	.101
	Dividend Payout Ratio Cash Profit	7.713	4.071	.055
	Earning Retention Ratio	7.093	3.638	.068
	Adjusted Cash Flow Times	4.043	4.599	.044
	Earnings Per Share	5.935	3.680	.067

Table 5 : Regression table indicating the impact expended by the independent variables on the dependent variable, i.e. CAAR (-5+5)

This means that the above ratios lead to a noticeable change in the company's market price in the period 5 days before Chennai's voting date of 24 April 2014 and 5 days after.

Here, it is important to note that the ratio - Return on Assets Excluding Revaluation - expends the highest impact on the dependent variable: CAAR (-5, +5)

4.2 Portfolio Optimization Result

PORTFOLIO OPTIMIZATION RESULTS — Export To New File

Product	Current Weighting	Current Units	Theoretical Change Weighting	Theoretical Change Units	Optimal Weighting	Optimal Units
CMC	1.08%	2.00	-0.77%	-1.42	0.31%	0.58
ECLERX	19.39%	36.00	-19.03%	-35.32	0.37%	0.68
HCLTECH	0.49%	1.00	-0.34%	-0.71	0.14%	0.29
HEXAWARE	2.15%	42.00	-1.88%	-36.75	0.27%	5.25
INFY	24.97%	23.00	-13.81%	-12.72	11.16%	10.28
INFOTECENT	3.01%	32.00	22.71%	241.47	25.71%	273.47
JUSTDIAL	2.26%	5.00	10.10%	22.32	12.36%	27.32
KPIT	2.68%	46.00	-2.26%	-38.92	0.41%	7.08
MINDTREE	33.80%	69.00	-33.44%	-68.28	0.35%	0.72
MPHASIS	6.74%	48.00	4.99%	35.55	11.73%	83.55
NAUKRI	0.24%	1.00	0.14%	0.57	0.38%	1.57
NIITTECH	0.13%	1.00	-0.00%	-0.02	0.13%	0.98
OFSS	1.00%	1.00	-0.82%	-0.82	0.18%	0.18
PERSISTENT	0.35%	1.00	-0.27%	-0.77	0.08%	0.23
POLARIS	0.07%	1.00	0.24%	3.35	0.31%	4.35
ROLTA	0.04%	1.00	-0.02%	-0.43	0.02%	0.57
TCS	0.76%	1.00	34.67%	45.86	35.42%	46.86
TECHM	0.63%	1.00	-0.58%	-0.92	0.05%	0.08
VAKRANGEE	0.04%	1.00	0.37%	8.70	0.42%	9.70
WIPRO	0.18%	1.00	0.03%	0.15	0.21%	1.15
Absolute	100.00%				100.00%	
Net	100.00%				100.00%	

Table 6 : Current and optimal portfolio composition (in units)

The current portfolio of CNX IT companies as held during the period of data collection is indicated with the help of Figure.

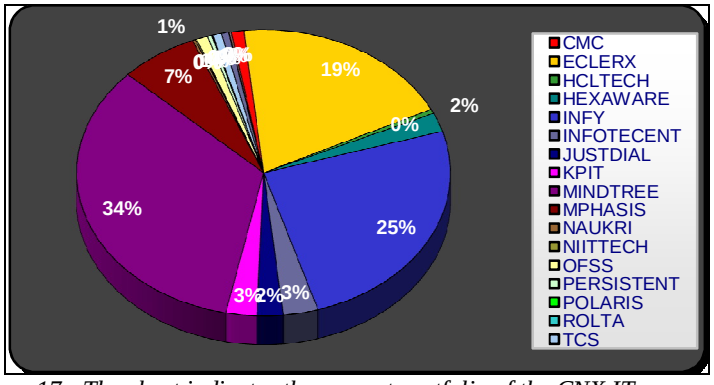

Figure 17 : The chart indicates the current portfolio of the CNX IT companies.

The return on investment is directly proportional with the level of risk undertaken. Hence, every level of risk will yield a different portfolio constituting of the companies of the industry in varied weights.

In the first case where the return is minimum in conjunction with risk, the weight of constituents will be as follows.

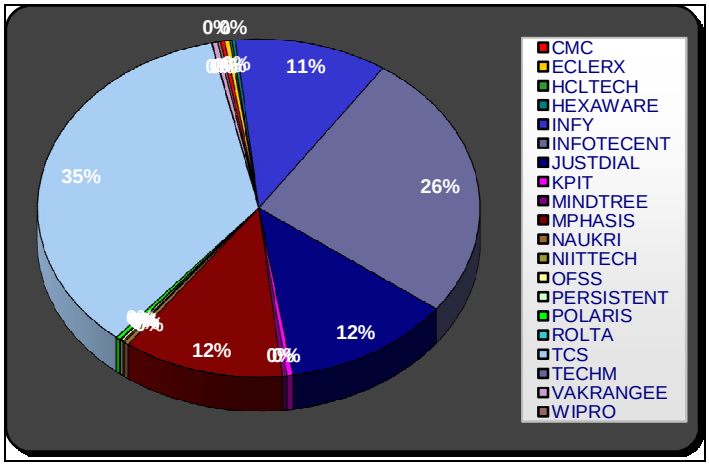

Figure 18 : The chart indicates the current portfolio of the CNX IT companies with minimum risk.

In the first case where the return is maximum in conjunction with risk, the weight entirely depends on JustDial alone and is held at 100%.

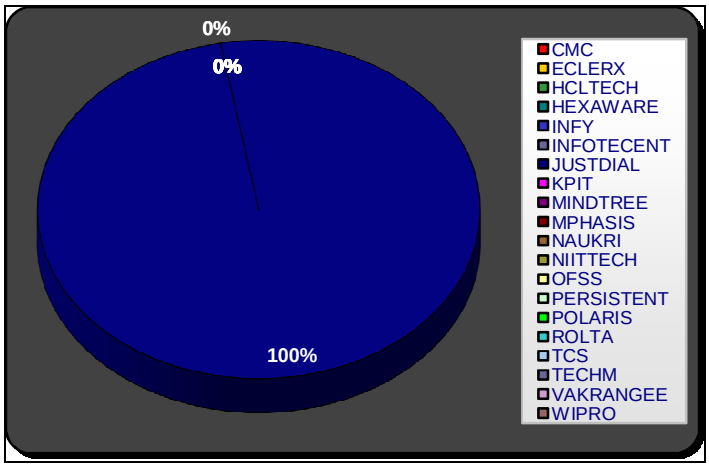

Figure 19 : The chart indicates the current portfolio of the CNX IT companies with maximum risk.

6. Conclusions and Limitation

6.1. Limitations of the Study

6.1.1. Limitations of Portfolio Optimization

The portfolio optimization is done subject to constraints. These constraints may be regulatory constraints, the lack of market with liquidity, or any of many other multitudes of factors.

1. Regulatory Constraint

Investors may be prohibited by law to hold some assets. In some cases, unrestricted portfolio optimization would lead to short-selling of some assets. However short-selling can be forbidden.

2. Transaction Constraint

Transaction constraints are the costs involved in trading in order to change the portfolio weights. Since the optimal portfolio changes with time, there is a need to re-optimize frequently. However, too frequent trading would incur too-frequent transactions costs. So the optimal strategy is to find the frequency of re-optimization and trading that appropriately trades off the avoidance of transaction costs.

6.1.2. Issues with Portfolio Optimization

Investment is a forward-looking activity. Thus the co-variances of returns and risk levels must be forecast rather than observed. Portfolio optimization presumes that the investor may have some aversion to risk and the stock prices might display significant differences between their historical or forecast values and what is experienced.

In particular, financial crises are characterized by a significant increase in correlation of stock price movements which may seriously degrade the benefits of diversification.

6.2. Scope for Further Research

The focus of my study is limited to the time period and the list of companies prevailing in the IT industry under the Nifty CNX IT index during April 2014. Similarly, the CAR was computed using a date range of 10 days, each before and after. Also, for sentiment analysis, the companies that were not active in twitter were not regarded.

Thus, given the situation, there is a lot of scope for further research in the following areas:

1. Analysis of sentiment
2. Computation of impact of abnormal returns over extended period of time
3. Working out with different models that best fit real world applicability with various other dependent variables.

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