

AN ANALYSIS OF OUTLIERS FOR FRAUD DETECTION IN INDIAN STOCK MARKET

Dr. Pankaj Nagar,

Asstt. Professor, Department of Statistics,
University of Rajasthan, Jaipur, India.

Gurjeet Singh,

Research Scholar, Department of Computer
Science, Jaggannath University, Rajasthan, India

ABSTRACT

Fraud Detection is of great importance to financial institutions. In this paper we have tried to study the Outlier Analysis in Stock Market Fraud Detection. Outlier Analysis is a fundamental issue in Data Mining, specifically in Fraud Detection. While observing the Indian Stock Market, we could detect that some of the Trading Entities have suspicious trading patterns that give rise to a doubt of having some malpractices in stock transactions within Indian Stock Market. All the facts are presented on the basis of data obtained from the official sites of BSE (Bombay Stock Exchange), NSE (National Stock Exchange) and SEBI (Securities and Exchange Board of India).

Keywords: Outlier Analysis, Data Mining, Stock Market, Fraud Detection.

INTRODUCTION:

Outliers have been informally defined as observations in a data set which appear to be inconsistent with the remainder of that set of data or which deviate so much from other observations so as to arouse suspicions that they were generated by a different mechanism. The identification of outliers can lead to the discovery of useful knowledge and has a number of practical applications in areas such as Stock Market Fraud Detection, Credit Card Fraud Detection, Athlete Performance Analysis, Voting Irregularity Analysis, Severe Weather Prediction etc.

Stock Fraud can be at a company level, or can be committed by a single stockbroker. Stock fraud can also vary in size from multi-million deals to penny stocks. We have taken Bulk Deal data of NTIL(Nu Tek India Limited) from BSE and NSE and analyzed this data to detect Outlier. NTIL is a telecom infrastructure services company providing rollout solutions for both fixed and wireless telecom networks. NTIL provides expertise in turnkey site build, active equipment implementations, operations & maintenance and technical support services. The company's core expertise lies in the breadth of services it offers in the telecom infrastructure space. It offers services to telecommunication equipment manufacturers, telecom operators as well as third party infrastructure leasing companies in installing and maintaining telecom network equipment & Infrastructure. NTIL is also involved in creation of In-building networks for the Wireless and Data Applications. Its client list constitutes all the prominent players in the telecom industry that includes Third Party Infrastructure Leasing Companies (like Indus Towers, Quippo, WTTIL), Telecom operators (like Airtel, Vodafone, Idia, Reliance Communications, Aircel) and Telecom Equipment Manufacturers (like Ericsson, Nokia Siemens Network, Huawei, ZTE, Motorola). There are lots of complains lodged in SEBI against Nu Tek India Ltd regarding Price Manipulation. SEBI investigation is going on, yet the outcome of investigation has not come.

NTIL share was listed at 192 rupees with FV 10 on 27th August 2008. In the mean time, splitted the FV to 5.00 (on 23rd December, 2009). The price of share fallen drastically from IPO listing price, Rs 192 to all time low of Rs 0.51 in BSE and Rs 0.50 in NSE on 08th May, 2012. The book value of the share is Rs. 32. We have taken the combined bulk deal data of NTIL from BSE and NSE since IPO date (27th August, 2008) to 30th June, 2012, and detected some Outliers from this data.

OUTLIER ANALYSIS:

Various detection systems or stock watch systems to monitor abnormal stock price changes have been developed to detect stock price manipulations. The main objective of Data Mining is to search for a general pattern for the input data. On the other hand, outlier analysis attempts to find the rare class whose behavior is very exceptional when compared to the rest of input data (**He, Xu, Huang, Deng, 2004, Coderre, 2009, Aggarwal & Guojun, 2003**). Novelty detection, or so-called outlier detection, is the identification of "novel" or "unknown" events that an expert system is not aware of during training or testing. Outliers may indicate abnormal running conditions and lead to significant performance degradation. An outlier is one that appears to obviously deviate from the others of the sample in which it occurs or an observation which appears to be inconsistent with the remainder of the dataset (**Barnett & Lewis, 1994**). According to **Aggarwal and Yu (2001)**, outliers may be considered as noisy points lying outside a set of defined clusters or may be defined as points that lie outside of the set of clusters but are also different from the noise. Many techniques are proposed to detect outliers, drawn from Statistics, Computer Science or Machine Learning. **Hodge and Austin (2004)** reviewed some fundamental approaches to solve the problem of Outlier Detection. This technique is usually named as Novelty Detection since it aims to define the boundary of normality instead of estimating the density of the dataset. In addition to the surveillance of stock price changes, Anomaly Detection Techniques have been applied to various fields such as Network Intrusion Detection (**Naiman, 2004; Scott, 2004**), Fault Detection (**Chen, Martin, & Montague, 2009; Martins, Pires, & Amaral, 2011; Yiakopoulos, Gryllias, & Antoniadis, 2011**), Financial Fraud Detection (**Juszczak, Adams, Hand, Whitrow, & Weston, 2008**).

CLASSIFICATION OF COMBINED BULK DEAL DATA OF NSE AND BSE:

Total 89 Trading Entities have made bulk deals in Nu Tek India Ltd. during 27th August, 2008 to 30th June, 2012. These trading entities are classified according to the following four patterns:

- **Category 1 (Only Buying Trading Entities)**- These Trading Entities may be considered as Normal as they did only buying.
- **Category 2 (Only Selling Trading Entities)**- These Trading Entities may be QIB (Qualified Institutional Buyers) or NII (Non Institutional Investors), may be considered as Normal, as they did only selling.
- **Category 3 [Buying and Selling Entities (Total Sell Qty<=Total Buy Qty)]**- We have found that some of the trading entities did Price Manipulation as they bought the shares at higher price and sold at lower price and incurred losses (Singh & Nagar, 2012).
- **Category 4 [Buying and Selling Entities (Total Sell Qty>Total Buy Qty)]**- These entities also may be QIB or NII. From this category, following Trading Entities has not done Intra Day Trading-
 - (1)Mavi Investment Fund Limited
 - (2)Struzzo Capital Services Pvt Ltd

So except above 2 entities, total 13 Trading Entities (shown in Table 1), seems to be suspicious because their Total Sell Qty is more than Total Buy Qty and they did Intra-Day-Trading [13], so we can consider these entities as Outliers.

Table 1: Total Transactions of Outlier Trading Entities (Category 4) and Excess Sell Qty (During 27th August, 2008 to 30th June, 2012)

S.No.	Outlier Trading Entity	Short Name	Total Buy Qty	Total Sell Qty	Weighted Avg. Buy Price	Weighted Avg. Sell Price	Excess Sell Qty
1*	Trans Financial Resources Ltd	TFRL	31199132	31675663	33	32.16	476531
2*	Akash Securities Private Ltd	ASPL	4755330	5646330	38.88	34.38	891000
3*	Shree Bhuvanakaram Tradinvest Pvt Ltd	SBTPL	3663532	3869009	2.97	2.69	205477
4	Krika Spice International Pvt Ltd	KSIPL	2264454	2266254	12.4	12.39	1800
5*	Bp Fintrade Private Ltd	BPFPL	2109853	2266269	25.15	24.97	156416
6	Tran Global Securities Ltd	TGSL	958956	959431	196.15	196.33	475
7	Sunil Capital & Securities Pvt Ltd	SCSPL	793006	831287	1.4	1.42	38281
8*	Pooja Equiresearch Pvt. Ltd.	PEPL	505000	1263450	43.49	44.68	758450
9	Aditya S Shah	ASS	465072	499625	197.95	191.2	34553
10	Mansukh Securities & Finance Ltd	MSFL	327008	327258	184.4	184.62	250
11	Virender Mansukhani	VM	231569	231659	178.4	178.19	90
12	Kanchan Chhabra	KC	159465	231909	37.64	36.33	72444
13	Yes Investments Vishal Kishore Bhatia	YIVKB	81500	89768	213.13	213.04	8268

*: Trading Entities having excess Sell Qty (More than 1,00,000 units)

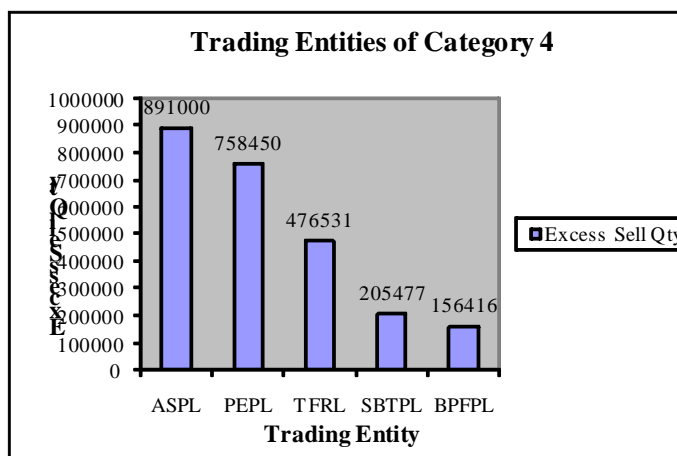


Fig 1: Excess Sell Qty > 1 Lac Unit (During 27th August, 2008 to 30th June, 2012)

Table 2: Only Intra Day Transactions of Outlier Trading Entities and Excess Sell Qty (During 27th August, 2008 to 30th June, 2012)

S.No.	Outlier Trading Entity	Total Buy Qty (A)	Total Sell Qty (B)	Weighted Avg. Buy Price	Weighted Avg. Sell Price	Excess Sell Qty
1*	Akash Securities Private Ltd	2787495	3054402	43.37	42.95	266907
2*	Shree Bhuvanakaram Tradinvest Pvt Ltd	2865530	3869009	3	2.69	1003479
3	Krika Spice International Pvt Ltd	2264454	2266254	12.4	12.39	1800
4	Tran Global Securities Ltd	958956	959431	196.15	196.33	475
5	Sunil Capital & Securities Pvt Ltd	793006	831287	1.4	1.42	38281
6*	Pooja Equiresearch Private Limited	15000	761449	43.98	44.98	746449
7	Mansukh Securities & Finance Ltd	327008	327258	184.4	184.62	250
8	Virender Mansukhani	231569	231659	178.4	178.19	90
9	Kanchan Chhabra	159465	231909	37.64	36.33	72444
10	Yes Investments Vishal Kishore Bhatia	81500	89768	213.13	213.04	8268

*: Trading Entities having excess Sell Qty (More than 1,00,000 units)

Table 3: Transactions of Outlier Trading Entities (During August 2008 – June 2009)

S.No.	Outlier Trading Entity	Total Buy Qty	Total Sell Qty	Total Volume (Buy +Sell Qty)	Total Transactions (Buy +Sell)	Weighted Avg. Buy Price	Weighted Avg. Sell Price	Excess Sell Qty
1	Yes Investments Vishal Kishore Bhatia	81500	89768	171268	2	213.13	213.04	8268
2	Aditya S Shah	465072	499625	964697	5	197.95	191.2	34553
3	Tran Global Securities Ltd	958956	959431	1918387	8	196.15	196.33	475
4	Mansukh Securities & Finance Ltd	327008	327258	654266	6	184.4	184.62	250
5	Virender Mansukhani	231569	231659	463228	4	178.4	178.19	90

Table 4: Transactions of Outlier Trading Entities (During July 2010-June 2011)

SN	Outlier Trading Entity	Total Buy Qty	Total Sell Qty	Total Volume (Buy +Sell Qty)	Total Transactions (Buy +Sell)	Weighted Avg. Buy Price	Weighted Avg. Sell Price	Excess Sell Qty
1	Pooja Equiresearch Pvt Ltd	505000	1263450	1768450	4	43.49	44.68	758450
2	Akash Securities Pvt Ltd	4755330	5646330	10401660	17	38.88	34.38	891000
3	Kanchan Chhabra	159465	231909	391374	2	37.64	36.33	72444
4	Trans Financial Resources Ltd	31199132	31675663	62874795	84	33	32.16	476531
5	Bp Fintrade Pvt Ltd	2109853	2266269	4376122	7	25.15	24.97	156416
6	Krika Spice International Pvt Ltd	2264454	2266254	4530708	6	12.4	12.39	1800

Table 5: Transactions of Outlier Trading Entities (During July 2011-June 2012)

S.No.	Outlier Trading Entity	Total Buy Qty	Total Sell Qty	Total Volume (Buy +Sell Qty)	Total Transactions (Buy +Sell)	Weighted Avg. Buy Price	Weighted Avg. Sell Price	Excess Sell Qty
1	Shree Bhuvanakaram Tradinvest Pvt Ltd	3663532	3869009	7532541	5	2.97	2.69	205477
2	Sunil Capital & Securities Pvt Ltd	793006	831287	1624293	2	1.4	1.42	38281

As per the information available on SEBI website, it has been observed that SEBI has banned the 3 Entities shown in **Table 6**, from Category 3 (**Singh & Nagar, 2012**), which were also involved in Bulk Deals of NTIL share and also manipulated share price of NTIL.

Table 6: SEBI Prior Action

Order Date	Order No.	IPO of	Name of Entity	PAN	Directions Issued	Time till which the directions will remain effective
40905	WTM/PS/1 VD-ID5 /42/2011/DEC	PG Electroplst Ltd.	Alfa Fiscal Services Pvt. Ltd.	AABCA8192K	Prohibited from buying, selling or dealing in any securities, in any manner whatsoever, till any further orders	From December 28, 2011 till further further directions
40905	WTM/PS/1 VD/ID8 /43/DEC/2011	Taksheel Solutions Ltd	Overall Financial Consultants Pvt. Ltd.	AABCO1577E	Prohibited from buying, selling or dealing in any securities, in any manner whatsoever, till any further orders	From December 28, 2011 till further further directions
40905	WTM/PS/1 D2/46/DEC/2011	Tijaria Polypipes Ltd.	Shri Chetan Dave	AFWPD6568D	Prohibited from buying, selling or dealing in any securities, in any manner whatsoever, till any further orders	From December 28, 2011 till further further directions

CONCLUSION:

In the current study, the principle objective is to detect fraudulent activities in Stock Market Fraud using Outlier Analysis approach. In this context the combined data of Bulk Deals through Indian Stock Markets (BSE and NSE), of Nutek India Limited is collected from the official websites and studied the trading patterns of 89 different Trading Entities, who had made Bulk Deals in NuTek India Ltd Share and found some doubtful outliers.

From the Table-1 and Fig-1 it can be easily observed that out of 13 Outlier Trading Entities, 5 are found having excess sell quantities (More than 1 Lac Units). Table-2 represents that out of these 5 trading entities (marked in Table-1) 3 are having excess sale recording in Intra Day transactions. Table-3 shows that during August 2008 to June 2009, Tran Global Securities Ltd created the highest volume and did the maximum transactions among the said 5 Outlier Trading Entities. Table-4 represents that during July 2010 to June 2011, Trans Financial Resources Ltd. created the highest volume and did the maximum transactions among the said 6 Outlier Trading Entities with excess sell quantities of 476531 units. While comparing the

transactions in Table-1 with that in Table-4, it is further observed that Trans Financial Resources Ltd. has all its transactions during July 2010 to June 2011. From Table-5 it can be observed that during July 2011 to June 2012, Shree Bhuvanakaram Tradinvest Pvt Ltd, created the highest volume and did the maximum transactions among the said 2 Outlier Trading Entities. Though the SEBI took action against some of the entities (Table 6) but perhaps these mentioned entities could not come in picture at that moment of time. This may happen if proper rectification system is not adopted. This research work is an endeavor in this direction.

From Table 3, 4 and 5, we can see that each Outlier Trading Entity did Bulk Deal during a particular period, and no any Outlier Trading Entity can be found in more than one table among Table-3, 4 and 5.

It is observed that Trans Financial Resources Limited is the most suspicious Trading Entity, who has made total 40 Buy bulk deals and 44 Sell Bulk Deals, and did Intra Day Trading 38 times in BSE and NSE (During 28th September, 2010 to 16th March, 2011), and we have also observed that mostly this Trading Entity has bought shares at higher price and sold at lower price and incurred losses. It creates a doubt that this Trading Entity has played major role in Price Manipulation, from Rs. 44 level to Rs 11 level.

REFERENCES:

- [1] Aggarwal, C. C., & Yu, P. S. (2001). Outlier detection for high dimensional data. In Proceedings of the ACM SIGMOD conference.
- [2] Barnett, V., & Lewis, T. (1994). Outliers in statistical data. New York: John Wiley & Sons.
- [3] Chen, T., Martin, E., & Montague, G. (2009). Robust probabilistic PCA with missing data and contribution analysis for outlier detection. *Computational Statistics & Data Analysis*, 53(10), 3706–3716.
- [4] David Coderre, *Computer Aided Fraud Prevention and Detection, A Step by Step Guide*, John Wiley and Sons, 2009
- [5] He, Z., Xu, X., Huang, J. Z. & Deng, S. (2004). Mining class outliers: Concepts, algorithms and applications in CRM. *Expert Systems with Applications*, 27, 681–697.
- [6] Hodge, V. J., & Austin, J. (2004). Survey of outlier detection methodologies. *Artificial Intelligence Review*, 22, 85–126.
- [7] Juszczak, P., Adams, N. M., Hand, D. J., Whitrow, C., & Weston, D. J. (2008). Off-the-peg and bespoke classifiers for fraud detection. *Computational Statistics & Data Analysis*, 52(9), 4521–4532.
- [8] Martins, J. F., Pires, V. F., & Amaral, T. (2011). Induction motor fault detection and diagnosis using a current state space pattern recognition. *Pattern Recognition Letters*, 32(2), 321–328.
- [9] Naiman, D. Q. (2004). Statistical anomaly detection via httpd data analysis. *Computational Statistics & Data Analysis*, 45(1), 51–67.
- [10] Rajesh K. Aggarwal & Guojun Wu. *Stock Market Manipulation — Theory and Evidence*, Working paper, Univ. of Michigan. March 11, (2003).
- [11] Singh, Gurjeet and Nager, Pankaj (2012): A case Study on Nutek India Limited Regarding Deep Falling in Share Price, *ResearchersWorld--Journal of Arts, Science & Commerce*, Vol.– III, Issue 2(3), April 2012.
- [12] Yiakopoulos, C. T., Gryllias, K. C., & Antoniadis, I. A. (2011). Rolling element bearing fault detection in industrial environments based on a K-means clustering approach. *Expert Systems with Applications*, 38(3), 2888–2911
- [13] Secondary Market Advisory Committee of SEBI, “Discussion paper on Short Selling and Securities Lending and Borrowing”, <http://www.sebi.gov.in/commreport/rep40.pdf>
- [14] Bombay Stock Exchange’s Website www.bse.com
- [15] National Stock Exchange’s Website www.nse.com
- [16] Nutek India Limited Website www.nutek.in
- [17] SEBI’s Investors Complain Website www.scores.gov.in
- [18] SEBI Website www.sebi.gov.in
