DEVELOPING AN EFFECTIVE MODEL FOR DETECTING TRADE-BASED MARKET MANIPULATION

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ABSTRACT

'Every day criminals may be stealing up to $400 million – 1 quarter of a percent of total trades – by manipulating the stock market', says Alex Frino of the Sydney based Capital Markets Co-operative Research Centre. Most manipulation is detrimental to the trading venue and its participants. Market manipulation impairs price discovery and misrepresent the fair value of a security. The distorted prices force investors to migrate to more efficient markets for deploying their capital. This reduces order flow and increases the cost of trading at a particular trading venue. It further motivates companies coming up with new issue to list their securities at other markets where there are better regulations and more efficient monitoring. Hence, ways and means of understanding and eliminating manipulative practices attract great interest from researchers, regulators and exchanges.

This research seeks to determine an appropriate model to help identify stocks witnessing activities that are indicative of potential manipulation through three separate but related studies. In a market like India, where there are about 5,000 plus securities listed on its major exchanges, it becomes extremely difficult to monitor all securities for potential market abuse. In this research, classifiers based on three different techniques namely discriminant analysis, a composite classifier based on Artificial Neural Network and Genetic Algorithm and Support Vector Machines are proposed. The proposed models help investigators, with varying degree of accuracy, to arrive at a shortlist of securities which could be subject to further detailed investigation to detect the type and nature of the manipulation, if any.

Chapter 1 provides an introduction to the topic. In this chapter, the market structure and an efficient stock market are discussed. The topics covering Indian stock markets, stock price manipulation and stock market surveillance are also introduced.

Chapter 2 provides a detailed literature survey on the topics covering efficient markets, market integrity, market manipulation and market surveillance. In Chapter 3 the issues, scope and objectives of the research

are discussed. In Chapter 4, the data and the three techniques that are used in the research are discussed.

In Chapter 5 and 6, the first classifier built based on discriminant analysis, which is one of the most popular classification techniques, is developed and applied. As a first step, the most popular and widely used Linear Discriminant Function is discussed as it has been widely used by researchers. It was also observed that researchers have used this technique without validating the assumption that governs the model. It is shown that the data collected from the Indian exchanges do not comply with the assumptions that govern the use of the Linear Discriminant Function. Based on literature review, it is shown that the Quadratic Discriminant Function (QDF) is the appropriate discriminant analysis based classification technique for instances where the data does not meet the stated assumptions of the Linear Discriminant Function, to categorize stocks as manipulated and non-manipulated. This classification is archived based on certain key market data variables that capture the characteristics of the stock.

In Chapter 7, a hybrid model using advanced data mining techniques like Artificial Neural Network and Genetic Algorithm is developed. An empirical analysis of this model is carried out to evaluate its ability to predict stock price manipulation for the same data that was used earlier. Further, the performance of this hybrid model is compared with a conventional standalone model based on Quadratic Discriminant Function (QDF). Based on the results obtained, it is concluded that the hybrid model offers better prediction accuracy than the conventional model.

In Chapter 8, the essentials of a Support Vector Machines (SVM) based model, first proposed by Vapnik, is presented in a simplified but detailed elucidation. Subsequently, a detailed description for applying SVMs to identify stocks that are witnessing activities indicative of potential manipulation is provided. Finally, the superiority of the model for the data has been established by comparing with the results obtained from the QDF and the ANN-GA composite classifier.

Keywords: *Artificial neural network, genetic algorithm, market manipulation, quadratic discriminant function, radial basis function, support vector function, surveillance*

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LIST OF ABBREVIATIONS

ADS	Advanced Detection System
ANN	Artificial Neural Network
ARIMA	Autoregressive Integrated Moving Average
ASBA	Application Supported by Blocked Accounts
BBC	British Broadcasting Corporation
BSE	Bombay Stock Exchange
CDSL	Central Depository Services (India) Limited
CMCRC	Capital Markets Co-operative Research Centre
DCA	Department of Company Affairs
DEA	Department of Economic Affairs
DMA	Direct Market Access
DSE	Dakha Stock Exchange
EMH	Efficient Market Hypothesis
EPS	Earnings Per Share
ETF	Exchange Traded Funds
FIX	Financial Information eXchange
GA	Genetic Algorithm
IMSS	Integrated Market Surveillance System
IOSCO	International Organization of Securities Commissions
IPO	Initial Public Offering
KKT	Karush Kuhn Tucker
LDF	Linear Discriminant Function
MCX	Multi Commodities Exchange
MDA	Multiple Discriminant Analysis
NASD	National Association of Securities Dealers
NSDL	National Securities Depository Limited
NSE	National Stock Exchange
OTC	Over the Counter
P/E	Price to Equity
QDF	Quadratic Discriminant Function

RBF	Radial Basis Function
RBI	Reserve Bank of India
SEBI	Securities Exchange Board of India
SEC	Securities Exchange Commission
SONAR	Securities Observation, News Analysis and Regulation
SOR	Smart Order Routing
SRO	Self-Regulating Organisation
SVM	Support Vector Machines
TSE	Tunisian Stock Exchange