PROJECT PAPER

A Review of Stock Market Manipulations & Their Detection

Submitted to

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Submitted by

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Letter of Transmittal

Date: 9th October 2023.

Dr. Md. Mohan Uddin
Professor,
School of Business & Economics.
United International University (UIU).
United City, Madani Avenue, Budda, Dhaka-1212.

Subject: Submission of Project report “A review of stock market manipulation & detection”.

Dear Sir,

I am writing to submit the final project report titled " A review of stock market manipulation & detection " as a requirement for my undergraduate program in Finance & Accounting at United International University as a prerequisite of my BBA Program.

With all due respect, I would want to let you know that I have spent a lot of time and energy learning about, exploring, and reporting most of the aspects of stock market manipulation and the techniques used to identify it. With the help of this project, I was able to research a challenging but crucial issue in the world of finance and accounting, and I'm eager to share what I learned with you.

The project report encompasses a comprehensive overview of the following key areas:
1. Introduction of Stock Market Manipulations.
2. Literature review of stock market manipulations & detection technique.
3. Ways of detection & prevention.
4. Conclusion & recommendations.

I would like to express my heartfelt gratitude to you for your invaluable guidance, support, and mentorship throughout this academic journey. Your feedback and suggestions have been instrumental in shaping the quality and depth of this project.

I believe that the knowledge and skills acquired during the preparation of this report have enriched my understanding of Finance & Accounting as well as the Stock market, it will serve as a strong foundation for my future academic and professional endeavors.

Once again, I want to extend my sincere appreciation for your support and guidance throughout this project. I look forward to your valuable feedback and hope that my work contributes positively to the academic community. Thank you for your time and consideration.

Sincerely,

A S M Fahad Ibn Faysal.
ID: 111162075

Declaration of the Student

I, A S M Fahad Ibn Faysal, a student at United International University (UIU), pursuing a bachelor's degree in finance & accounting, hereby declare that the project report titled "A Review of Stock Market Manipulation & Detection" submitted in partial fulfillment of the requirements for the award of my undergraduate degree is my original work. All the information, data, and analysis presented in this report are the result of my independent research and study.

I further declare that:

1. The sources and references used in this project report have been duly acknowledged and cited in accordance with the appropriate academic conventions and citation styles.

2. Any assistance or guidance received from individuals, organizations, or sources external to this university for the completion of this project has been appropriately acknowledged in the bibliography section.

3. This project report has not been previously submitted for the fulfillment of any other academic qualification at this university or any other educational institution.

4. I have not engaged in any form of academic dishonesty, including plagiarism or unauthorized collaboration, while working on this project.

I understand that any misrepresentation or violation of academic integrity in this project report may result in disciplinary action in accordance with the university's policies and regulations.

Date: 5th November 2023.

Full Name: A S M Fahad Ibn Faysal.

Student ID: 111 162 075.

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I would like to express my sincere gratitude to the following individual whose guidance, support, and encouragement played a pivotal role in the successful completion of this project:
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I would like to express my gratitude to all the researchers and scholars whose work I referenced in this report. The information they provided has been significant in forming the theoretical framework of my project.
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Abstract

The study represents a thorough review of the stock market's economic significance and the ongoing issue of manipulative practices. It draws attention to the need for precise regulatory guidelines and continuous developments in detecting technologies. It is highlighted that cooperation between regulators, financial institutions, and technology suppliers is essential for upholding market integrity and encouraging further study in this area.

Conducting systematic research, data from Dimensions AI was acquired and organized for articles published between 2019 and 2021. After a thorough data cleaning and categorization process, visual aids like charts were utilized. This approach aimed to gain insights into the diverse methods employed for detecting stock market manipulation and enhancing market integrity.

This study represents a diverse landscape of tactics utilized by participants in the financial market. It explores a wide range of strategies, from those aimed at influencing stock prices and trade volumes to collaborations among market players and the use of advanced tools like botnets for automated manipulation. Additionally, the study sheds light on modern detection approaches like machine learning, network analysis, and the strategic use of game theory. Furthermore, it emphasizes the vital role played by legal and regulatory frameworks in upholding market honesty and delves into practical risk management techniques. This narrative voyage contributes to the ongoing effort to strengthen financial markets against manipulation, fostering confidence among investors and stakeholders.

In summary, these progressions in detection techniques offer a stronger and safer financial market, building confidence and trust among all involved. As researchers continue to push the limits of manipulation detection, the future holds the potential for even better market honesty and protection.

Key Words:

Stock, share, Securities, stock market, stock exchange, trade, manipulation, manipulative, fraud, detection, identification, uncovering, detect.

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Chapter 1

Introduction

1.1. Background of the study

A stock market is a platform where publicly traded companies issue their shares to the general investors and investors invest into a company with an exchange of the ownership of shares of that company. The share market or Stock market is one of the key components of the economy. Historically this platform is also known to a few individuals or organizations with a view to producing unethical profit by distorting the hygiene of the platform. As a result of this artificial involvement in share market manipulation, researchers and market specialists are working to secure the interest of the general investors and ensure a fair market operation. This project is all about summarizing all the previous research from all around the world (publishes during 2019-2021) and opening the scope of future research.

1.1.1. **Stock Market**

The stock market is formed by the companies that decide to issue stock to raise capital. Once a company decides to go public it needs to go through an initial public offering (IPO) process, where it offers its stock to the public for the first time. After the IPO company's stocks are traded on the stock exchange, where investors buy & sell their stocks based on the perceived value.(Chen, n.d.)

Stoc market manipulations refers to any fraudulent or deceptive activity that manipulates the stock market to artificially inflate or deflate the stock price. This includes spreading rumors about a company, insider trading or conducting illegal trades to distort the stock market.

Detection of stock market manipulation typically involves a thorough analysis of trading pattern, market data & regulatory compliance.(CEPF®, n.d.; *Stock Market - Wikipedia*, n.d.)

The stock market is consisting of followings institutions or components,

1.1.1.1. Stock exchange:

The physical or virtual marketplace where stocks are bought and sold. Examples include the New York Stock Exchange (NYSE), Dhaka Stock Exchange (DSE).

1.1.1.2. Stock indices:

These are the measurements of overall performance of a specific set of stocks. Examples include S&P 500 and Dow Jones Industrial Average. (*Stock Market - Wikipedia*, n.d.)

1.1.1.3. Brokers:

These are individuals or companies that act as intermediaries between the buyers & sellers. (*Stock Market - Wikipedia*, n.d.)

1.1.1.4. Traders/ Investors:

Investors are the participants of the stock market who invest on stocks or trade their stocks with a view to making profit. (Maheshwari, 2023)

1.1.1.5. Stock Price:

These are the values assigned to each stock based on the supply & demand in the market.

(Chen, n.d.; Fuentes, 2017; Maheshwari, 2023)

1.1.2. **Fundamental Mechanism of Stock Market**

The stock market operates based on several fundamental mechanisms that allow investors to buy and sell shares of publicly traded companies. These mechanisms include:

1.1.2.1. Supply & demand:

The stock market functions are based on the principle of supply and demand. The price of a stock is determined by the interactions of the buyers & sellers. If there I more buyers than sellers then the demand is higher, then the demand is increases and the price tends to rise. Conversely, if there are more sellers than buyers then the price tends to fall. (Hayes, 2023)

1.1.2.2. Market Participants:

Various participants are involved in the stock market including individual investors, institutional investors (such as mutual funds & pension funds), brokers, market makers, and traders. These participants play different roles in buying, selling, and facilitating transactions. (*Types of Market Participants in Stock and Their Roles?* 2021)

1.1.2.3. Liquidity:

The stock market provides liquidity, allowing investors to convert their shares into cash quickly. Liquidity refers to the ease with which shares can be bought or sold without significantly impacting the price. High liquidity is beneficial for the investors, as it ensures that they can enter & exit positions without major obstacles. (Maheshwari, 2023)

1.1.2.4. Price Discovery:

The stock market facilitates price discovery, meaning that it's determines the fair value of a company's shares based on the supply and demands dynamics & market information. Investors and traders analyze various factors such as financial performance, industry trends, and news to estimate the stock's value. (Hayes, 2023; "Stock Exchange," 2018)

1.1.3. **List of benefits for an investor have received from stock market**

1.1.3.1. Capital Growth:

Investors who buy the shares of companies with potential for growth can profit if the stock price increases over time. They can sell their shares at a higher price, realizing capital gains. (*Benefits Of Investing in Stocks*)

1.1.3.2. Dividend Income:

Some companies distribute a portion of their profits in the form of dividends. Investors who own the dividend-paying stock can receive a regular income from these dividends. (*Benefits Of Investing in Stocks*)

1.1.3.3. Portfolio Diversification:

The stock market provides an opportunity for investors to diversify their investment portfolios. By investing in a range of stock across different industries, geographics locations, and market sectors, they can spread their risk and potentially benefit from the overall growth of the market. (*Investing in Stocks*)

1.1.3.4. Ownership & Voting rights:

Shareholders have ownership stakes in the companies they invest in, entitling them to voting rights on certain matters. They can participate in important company decisions, such as electing the board of directors or approving mergers & acquisitions. (Hayes, 2021)

1.1.3.5. Economic Growth

A well function stock market helps facilitate capital formation which enables companies to raise funds for expansion, research & development, and innovation. This, in turn, can contribute to economic growth and job creation.

It is important to note that investing in the stock market carries risks, and the value of investment can fluctuate. It's advisable to conduct thorough research, seek professional advice, and diversify investments to manage risk effectively. (Benefits Of Investing In Stocks, n.d.; Maheshwari, 2023)

1.1.4. **Stock Market Manipulations**

Stock market manipulation refers to the illegal or unethical practices employed by individuals or groups of artificially influence the price or trading volume of a particular stock or securities in the financial market. These manipulative activities are generally aimed at creating the false impression of supply, demand, or market conditions to deceive other investors and gain an unfair advantage. (*What Is Manipulation in the Stock Market?*)

1.1.4.1. International News of Stock Market Manipulation

Between 2019 and 2021, there were several incidents in the stock market manipulations that garnered international attention. Here are few highlighted examples:

1.1.4.1.1. Wirecards AG (2019-2021)

Wirecard a German Payment processor and financial services for Greensill Capital (2021); Greensill Capital, a UK-based supply chain finance company, collapsed in 2021 due to financial irregularities and fraudulent activities. The company provided short-term loans to businesses, and its collapse had significant implications for supply chains worldwide. It involved complex financial arrangements and alleged misrepresentations of its business model and risk exposures.ovider faced a major scandal involving accounting fraud & market manipulations. The company artificially inflated its revenue and profit though fraudulent accounting practice. Wirecard's stock price collapsed, and the company filed for insolvency in June-2020. The scandal led to investigations, arrests, and legal actions against the company's executives.(Wilmarth, 2021).

1.1.4.1.2. Luckin coffees

Luckin Coffee, a Chinese coffeehouse chain, was involved in a fraud scandal that emerged in 2020. The company fabricated sales figures, aiming to inflate its market value and attract investors. The

fraud was exposed, resulting in a significant decline in the company's stock price, multiple executive resignations, and investigations by Chinese regulatory authorities.(Kara, 2021)

1.1.4.1.3. Archegos Capital Management (2021)

Archegos Capital Management, a family office hedge fund, experienced a major market meltdown in March 2021. The fund had taken highly leveraged positions in risky derivatives tied to media and tech stocks. When several of these positions moved against the fund, it triggered massive selloffs, causing substantial losses for Archegos and its prime brokers. The incident raised concerns about risk management in the hedge fund industry. (MacDowell, 2021)

1.1.4.2. **Major Stock Market Manipulations in Bangladesh**

One of the major stock market manipulations in Bangladesh was the 2010-2011 stock market crash, commonly referred to as the "Stock Market Scam" or "Bubble Burst." During this period, the Bangladesh stock market experienced a significant rise in prices, followed by a sudden and drastic collapse.

The stock market witnessed a rapid increase in share prices between 2009 and 2010, fueled by aggressive speculation and excessive leverage. In the market, numerous investors, even individual investors, invested their funds because they thought the rising trend would go forever. The market finally saw a major meltdown in late 2010, though. Investors experienced panic and substantial financial losses as the benchmark index, the Dhaka Stock Exchange (DSE) General

Index, lost more than 25% of its value in a short period of time. (“2011 Bangladesh Share Market Scam,” 2022).

Several things, particularly market manipulation and fraudulent activity, were blamed for the crisis. In order to artificially pump-up stock prices, foster a false feeling of market euphoria, and attract unaware investors into the market, it was believed that several brokerage firms, individual investors, and powerful groups conspired.

It was thought that manipulative activities, including insider trading, pump and dump schemes, and market manipulations, were common at the time. Inadequate monitoring systems and low regulatory control were also found to have contributed to the manipulation. (“Market Manipulation,” 2023)

The crash resulted in a significant erosion of investor confidence, a decline in market participation, and financial losses for many investors. It led to public outcry and demands for accountability, prompting regulatory authorities to take measures to restore market stability and strengthen market regulations. (Gottesman & Morey, 2023)

To conduct investigations into and punish individuals responsible for market manipulation, Bangladesh's Securities and Exchange Commission (SEC) initiated action. It introduced regulatory reforms, enhanced surveillance mechanisms, and implemented measures to promote transparency, investor protection, and market integrity. (*Bangladesh Securities and Exchange Commission*, n.d.)

The 2010-2011 stock market crash served as a crucial lesson for Bangladesh's stock market and highlighted the importance of robust regulatory frameworks, effective oversight, and investor education to prevent market manipulations and maintain a fair and transparent marketplace. (“2011 Bangladesh Share Market Scam,” 2022)

1.2. Statement of the Problem

In the modern era of science & technological advancement stock market manipulations techniques are getting more complex and difficult to detect. Traditional approaches to detection aren't effective enough, for this aspect machine learning and others new approaches are applied on the stock market. There is lots of research work about upgrading the stock market regulatory system with machine learning & other techniques. But they aren't all together and for this reason it seems little difficult to understand the overall advancement.

This project work it dedicated to supporting the future researchers to have all the research summary during 2019-2021, to summarize the stock market manipulations and their detection.

1.3. Objective of the study

- Identifying common patterns and trends in stock market manipulative activities.
- Assess how technological advancement has affected the landscape of stock market manipulation.
- Explore machine learning and data analysis techniques for detection of stock market manipulation.

- Exploring opportunities for collaboration between regulatory authorities, financial institutions, and technology providers to enhance detection and prevention efforts for stock market manipulation.

1.4. Significance of the study

The studies published between 2019 and 2021 in the domain of stock market manipulation detection offer a critical resource for policy makers. They not only unveil emerging manipulation tactics but also introduce advanced technologies like ELMAD, Ensemble Neural Networks, and Kernel Principal Component Analysis (KPCA). These innovations equip policy makers with powerful tools to proactively identify and combat financial fraud. With heightened accuracy and reduced false positives, these studies empower regulators to bolster market integrity and safeguard investors. The recommendations for real-time monitoring and collaboration between regulatory bodies and financial institutions underscore their timely relevance in an ever-evolving financial landscape, making these studies indispensable for policy makers seeking to maintain market transparency and trust.

In the dynamic realm of stock market manipulation and detection, recent articles published between 2019-2021 have illuminated promising pathways for future research. These studies have introduced cutting-edge detection techniques, effectively mitigated false alarms, and underscored the ethical dimensions of surveillance. Moreover, they emphasize the importance of global collaboration and data sharing, fostering a climate ripe for innovative solutions. As the financial landscape continues to evolve, these research contributions serve as a robust foundation, inviting future scholars to explore uncharted territories, refine methodologies, and enhance regulatory frameworks to safeguard market integrity.

Chapter 2

Research Methods

2.1. Article Collection dimensions AI.

2.1.1. Identifying the Source of Article

The significant part of this study is identifying the source of information or articles, in this section honorable project supervisor Dr. Md. Mohan Uddin Sir deserves all the credits of suggesting to collecting the data from Dimensions AI.

2.1.2. Searching by key words

After the source is decided then the main task begins with collection of data. In this phase, the title of this project is segregated with multiple words, and then a list of synonyms was prepared for each of the words. Following the instruction of the project supervisor, put those key words into the search option and selected the time duration 2019 to 2021.

2.1.3. Download & Organize:

Now it's become crucial to organize those articles for the purpose of further approaches. Because after the search there are lots of articles about cryptocurrency and others sort of trading, which are irrelevant for the study.

2.2. Sorting out the different components of the Articles.

2.2.1. Sorting out component

At this moment information has been organized for summarizing and segregating according to the instructions. Information is stored in an excel document. Information is segregated by name of the Authors, Country, Data Type, Variables, Way of detection, Results/Findings, Implications.

2.2.2. Structure the segregated component

After thoroughly reading out all the articles a structured data is developed for the study. Data is structured based on the component. All the information about every article is structured into a specific excel sheet, example: all the data type are into a sheet, all the country are in another sheet etc.

2.3. Organizing Information.

2.3.1.1. Clean & Prepare Data

Before the data is being prepared, there is a data cleaning process. Where an assurance is given that the data is on this project is clean & error free, and there are no duplicates, no missing value and data format is appropriate.

2.3.1.2. Organize Data

Into this section we organized all the scattered data to have visualized and summarized data.

2.3.1.3. Summarize the Information

After all the extracted and summarized data in excel, data level, titles etc. are being added to data to make it more informative. Then copy those summarized data into the research presentation & documentation.

2.4. Country profile of the articles reviewed and summary:

The study has covered lots of countries research based on stock market manipulation and detection approaches, following table provides a summarize visual:

Table 2.1 List of Countries of reviewed articles

Country	**No of Article**
India	2
Chaina	3
Sri Lanka	1
United Kingdom	1
Brazil	4
Malaysia	2
Iran	1
Ukraine	1
Kuwait	1
Georgia	2
USA	1
Nepal	1

The literature on detecting stock market manipulation encompasses a wide range of approaches, from machine learning techniques and unsupervised learning to financial models and regulatory aspects. These studies collectively highlight the importance of developing effective tools and methodologies to ensure the integrity of financial markets and protect investors from fraudulent activities. Further research in this area is needed to address evolving manipulation tactics and enhance detection methods.

Chapter 3

Review of the Literature

Stock market manipulation is still a major issue in financial markets, and the necessity for robust detection techniques has expanded in recent years. This assessment of the literature looks at significant research publications released between 2019 and 2021 to get insights into the growing environment of stock market manipulation and the most advanced approaches for detecting it.

3.1. Market Manipulation Techniques

Stock market manipulation is a major problem in the financial sector, referring to a variety of dishonest actions taken with the intention of artificially inflating the value of assets. These actions harm investors who could sustain substantial losses as well as the integrity of the financial markets. Market manipulation detection is a topic of utmost importance that has attracted the attention of both academic scholars and regulatory organizations. We explore many aspects of market manipulation detection in this literature review, illuminating the numerous approaches, strategies, and models used in this crucial task. (Lehman, 2022)

3.1.1. Price Manipulations

Pricing manipulation is the practice of influencing a security's price artificially, usually to gain an unfair financial advantage. Trading activities provide investors the chance to acquire or sell securities at favorable prices by enabling a security's price to increase or decrease. (“Market Manipulation,” 2023)

3.1.2. Volume Manipulations

Volume manipulation and trade activity are connected. It entails intentionally boosting or lowering a security's trading volume. Many trades may be executed by manipulators to give the impression that interest in a stock is increasing or decreasing. (Twin, 2022)

3.1.3. Trade Reversal

Reversing deals after they have been executed allows manipulators to swiftly create the appearance of trading activity. Data on trade volume may be distorted as a result, misleading other market players. (Mitchell, 2021)

3.1.4. Spoofing

Spoofing is a dishonest trading technique in which a trader places orders with the goal of canceling them before they are carried out. In order to deceive people into making trading decisions based on incorrect information, fraudulent supply and demand signals must be generated. (Mendonça & De Genaro, 2020; “Spoofing (Finance),” 2021)

3.1.5. Pump & Dump

Pump and dump strategies entail artificially increasing the price of a security by using false or deceptive assertions, sometimes disseminated through promotional activities. Fraudsters boost the price and then sell their assets at a profit, sending the price down and leaving other investors with losses. (Dhir, 2022)

3.1.6. Layring

Layering, often referred to as order layering or fake layering, is a method of manipulating the market in which traders' issue several buy or sell orders at various price levels to provide the impression of high trading activity. These directives aim to alter perception rather than be carried out. ("Layering (Finance)," 2021)

3.1.7. Quote Stuffing

Quote stuffing is a rapid-fire technique where traders flood the market with a high volume of orders and cancellations in a very short time. This tactic can overload market data feeds, disrupt trading algorithms, and create confusion among market participants. (Downey, 2022)

3.1.8. Collusion

Collusion in financial markets involves a group of market participants working together to execute manipulative trading strategies. These colluding groups engage in coordinated trading to achieve their goals, often escaping detection by appearing as normal transactions. (Madurawe et al., 2021)

3.1.9. Time Based manipulation

Some manipulation schemes take advantage of timing within the market. For example, manipulative actions might be timed to coincide with periods of market uncertainty or low liquidity, making detection more challenging. (Gyawali, 2021)

These various types of market manipulation highlight the ingenuity and adaptability of manipulators in their efforts to distort stock prices and trading activity for their own gain. Detecting and preventing such practices is essential for maintaining fair and transparent financial markets.

3.2. Detection Techniques

Into the following section here are the summary of major approaches which have the potential to drive the detection process stock market manipulation into the next stage of the international detection process.

3.2.1. Machine Learning Approaches for Detection

The use of machine learning techniques, particularly Extreme Learning Machine framework (ELMAD), has shown promise in identifying market manipulation scenarios through pattern recognition. In one study, ELMAD achieved high accuracy rates of 84.02% for price manipulation detection and 82.70% for volume manipulation detection using data from the Bombay Stock Exchange (BSE). The approach emphasizes continuous constraints in training to produce optimal solutions quickly.(Sridhar & Sanagavarapu, 2021)

3.2.2. Detection of Colluded Traders

Market manipulation often involves collusion among traders. Research proposes the use of clique analysis in trading networks to detect colluded traders. This approach investigates the clique structures in manipulated stocks and finds that manipulated stocks exhibit a higher number and weight of cliques. Detecting colluded traders based on clique weight has proven effective in distinguishing manipulated stocks. (Shi et al., 2019)

3.2.3. Trade Based Manipulation

A study explores trade-based manipulations using supervised machine learning classification models. The dataset comprises cases of manipulation on the Borsa Istanbul (BIST) from 2010 to

2015. Results demonstrate the success of supervised machine learning techniques in detecting trade-based manipulations based on accuracy, sensitivity, and F1 score, with an F1 score of 91% and 93% accuracy. (Uslu & Akal, 2021)

3.2.4. Collusion Detection Through Mining

Collusion within stock markets often involves seemingly normal transactions and requires consideration of time. Research proposes a model that employs graph mining and anomaly detection. Investor graphs represent relationships between investors, and techniques like OPTICS and Spectral clustering help extract collusive groups. Local Outlier Factors act as anomaly detectors to filter results effectively. (Madurawe et al., 2021)

3.2.5. Semi-Supervised Learning and Immune System-Inspired Approach

A unique semi-supervised learning approach combines an altered dendritic cell immune system-inspired approach with Kernel Density Estimation (KDE) clustering to detect manipulation. The approach minimizes dimensionality and eliminates the need for supervised training during preprocessing. Validation on high-frequency trading data shows substantial improvements compared to existing methods. (Rizvi et al., 2019a, 2019b)

3.2.6. Game Theory & Detection Software

This research establishes a framework connecting game theory and detection software to estimate the probability of stock price manipulation fraud. The method helps define optimum threshold values for detection software's alarm structures. The approach is illustrated using the "plier bubble" financial episode in Brazil, offering a valuable tool for risk management in the stock market. (Bernardino et al., 2021)

3.2.7. Unsupervised Learning for Price Manipulation Detection

An unsupervised learning model based on an affinity matrix is proposed to detect price manipulation. It uses an autoencoder to learn representations of normal stock prices and kernel density estimation for reconstruction error. This approach shows significant improvements in detection performance over existing methods. (Rizvi et al., 2020)

3.2.8. RNN- Based Ensemble Learning for Detection

Researchers introduce an RNN-based ensemble learning framework to detect stock price manipulation activities. The approach combines trade-based features and characteristic features of

listed companies, achieving an average improvement of 29.8% in AUC value compared to existing approaches. (Wang et al., 2019)

3.2.9. Intelligent Visual Fraud (IVF) System

The IVF system is introduced as a potential solution for detecting price manipulation frauds. The study evaluates the effectiveness of IVF in comparison with traditional alert-based surveillance systems, showing that intelligent surveillance systems can effectively detect price manipulation in stock markets. (Kasgari et al., 2019)

3.2.10. Beneish & Altman Models for Detection

This study combines the Beneish M-score model for detecting profit manipulation and the Altman model for identifying financial distress in private commercial banks in Nepal. While the Beneish model was not effective in detecting manipulation in banks, it highlights the importance of using appropriate models for different contexts. (Akra & Chaya, 2020)

3.2.11. Botnets for Stock Market Manipulations

Research explores the feasibility of using botnets to automate stock market manipulation. It discusses the technical challenges, such as avoiding detection and adapting automation techniques.

The study presents a proof-of-concept malware, Bot2Stock, and evaluates its effectiveness through agent-based market simulations. (Yagemann et al., 2020)

3.2.12. Inventory Distribution & Earning Management for

This research examines the relationship between stock-based incentives for managers and the distortion of inventory for financial reporting purposes. It finds that managers may manipulate inventory to influence stock prices and reports positive correlations between abnormal excess inventory and executive incentives. (*The Effects of Stock-Based Incentives on Inventory Management - Dimensions*, n.d.)

3.2.13. Detection Techniques Summary

Table 3.1 Summary of detection techniques

SL	Detection Techniques
1	Machine Learning Approaches
2	Generalized Methods
3	Graph Mining Techniques
4	Spectral Clustering
5	Semi Supervised Machine Learning
6	Supervised Machine Learning
7	Unsupervised Machine Learning
8	Kernel Density
9	Game Theory
10	Dendric Cell Algorithm
11	Non-Parametric Density
12	Ensemble Neural Network
13	Kernel Components Analysis (KCA)

14	Altman & Beneish Model
15	Beneish M-Score Model
16	RNN-EL (RNN-Ensemble Learning)

3.3. Role of Regulatory and Legislative Bodies

The effect of legislation and regulation on market manipulation is a crucial aspect of ensuring the integrity and fairness of financial markets. Based on the information provided in the previous responses, let's elaborate on how legislation and regulation impact the detection and prevention of market manipulation:

3.3.1. Legal framework for detection and prevention:

Legislation and regulation establish the legal frameworks and guidelines that govern financial markets. They define market manipulation, specify prohibited practices, and outline penalties for violations. These legal frameworks provide the foundation for detecting and prosecuting market manipulators. (Clayton, 2017)

3.3.2. Role of regulatory bodies:

Regulatory bodies, such as the Securities and Exchange Commission (SEC) in the United States or the Securities and Exchange Board of India (SEBI), play a central role in overseeing and enforcing market regulations. They have authority to look into unethical trading activity and pursue

punishment against manipulators. (Sridhar et al., 2020; Sridhar & Sanagavarapu, 2021; *The Effects of Stock-Based Incentives on Inventory Management - Dimensions*)

3.3.3. Market Surveillance:

The trading operations are regularly monitored by sophisticated market surveillance systems used by regulatory organizations. These algorithms examine a sizable volume of trade data to spot any suspicious or odd trends that could point to market manipulation. (Clayton, 2017)

3.3.4. Enforcement and Penalties:

Regulations and laws provide regulatory agencies the authority to uphold laws and establish sanctions on people or organizations regarded to have engaged in market manipulation. To prevent prospective manipulators, penalties may include fines, trade bans, and judicial proceedings. (Enforcement | FINRA.Org) ("Market Manipulation - Definition, Laws, Penalties,") (Clayton, 2017)

3.3.5. Transparency & Reporting:

Transparency standards for market participants are frequently mandated by laws. Financial disclosure is often required of businesses who trade on stock exchanges, to ensure shareholders

have possession of accurate and up-to-date data. Through the exposure of abnormalities or inconsistencies in financial records, transparency aids in the discovery of manipulation. (Bloomfield & O'Hara, 1999; Nusaybah)

3.3.6. Collaboration with exchanges & industry:

To distribute data and efficient methods for detecting and avoiding manipulation, regulatory bodies work closely with markets and commercial groups. This cooperation encourages a planned strategy for market observation. (Silvers, 2019)

3.3.7. Market surveillance technologies:

For better market monitoring, regulatory organizations invest in cutting-edge technology like data analytics and machine learning. These tools make it possible to analyze massive databases in real-time for trends in manipulating and unethical trading activity. (Kumar, 2021)

3.3.8. International Cooperation:

In order to share information and best practices for identifying and preventing manipulation, regulatory authorities work closely with stock exchanges and industry groups. This cooperation encourages a planned strategy for market observation. (Clayton, 2017)

3.3.9. Updates & Amendments:

Regulations and new legislation change to reflect evolving market conditions and new forms of manipulation. Regulatory bodies periodically review and update rules to address new challenges and risks in the financial markets. (Clayton, 2017)

3.3.10. Investors' Confidence:

A well-regulated market with effective detection and enforcement mechanisms enhances investor confidence. Investors are more likely to participate in markets where they believe that manipulation is actively monitored and swiftly addressed. (Ko, 2017)

In summary, legislation and regulation play a pivotal role in the detection and prevention of market manipulation. They establish the legal framework, empower regulatory bodies, and promote transparency and accountability in financial markets. Effective regulation is essential for maintaining the trust and credibility of financial markets and protecting the interests of investors.

3.4. Management of stock market manipulation risks

Risk management in the context of stock market manipulation is a critical component of maintaining the integrity and stability of financial markets. Given the information provided in the

previous queries regarding various types of market manipulation and the role of legislation and regulation, let's explore how risk management strategies can be applied to mitigate the potential risks associated with market manipulation. (Will, 2022)

3.4.1. Risk Identification:

The first step in risk management is identifying the potential risks associated with market manipulation. This involves understanding the various manipulation schemes, recognizing vulnerabilities in trading systems, and staying informed about emerging threats. (Liu et al., 2021)

3.4.2. Regulatory Compliance:

Compliance with existing regulations is a fundamental aspect of risk management. Market participants, including brokerage firms and listed companies, must adhere to regulatory requirements aimed at preventing manipulation. Compliance reduces the risk of regulatory sanctions. (Editorial, 2023)

3.4.3. Data Analytics & Machine Learning:

Utilizing data analytics and machine learning techniques can enhance risk management in detecting manipulation. These technologies can analyze vast datasets to identify patterns,

anomalies, and suspicious trading activities indicative of manipulation. (Sridhar & Sanagavarapu, 2021; Uslu & Akal, 2021) (Zhai et al., 2018)

3.4.4. Market Transparency:

Transparent reporting of financial information by listed companies is crucial. Providing investors with accurate and up-to-date financial data helps mitigate the risk of manipulation through false or misleading disclosures. (Hunton et al., 2006)

3.4.5. Whistleblower Programs:

Implementing whistleblower programs encourages individuals to report suspicious activities without fear of retaliation. Whistleblower reports can provide valuable information for detecting and preventing manipulation. (*SEC.Gov | Office of the Whistleblower*, n.d.)

3.4.6. Collaboration with Regulatory Authorities:

Market participants should collaborate closely with regulatory authorities. This includes sharing information about potential manipulation, cooperating in investigations, and adhering to regulatory directives. Such collaboration strengthens the collective effort against manipulation. (Silvers, 2019)

3.4.7. International Coordination:

Given the global nature of financial markets, international coordination among regulatory bodies is essential. Coordinated efforts can help address cross-border manipulation effectively and reduce associated risks. (Silvers, 2019)

3.4.8. Robust Risk Assessment:

Market participants should conduct comprehensive risk assessments that consider the potential impact of market manipulation on their operations and financial health. This assessment can inform risk mitigation strategies. (A. Aguiler, 2013)

3.4.9. Enhance Due Diligence:

Brokers, asset managers, and investment firms should conduct enhanced due diligence when onboarding clients or executing trades. Vigilance in identifying unusual trading instructions or patterns can help prevent manipulative activities. (A. Aguiler, 2013)

3.4.10. Investments in Technology:

Investing in advanced cybersecurity and technology solutions is crucial to protect trading platforms and systems from hacking or manipulation attempts. Ensuring the integrity of trading infrastructure is essential for risk management. (*Report to the Congress: Impact of Technology on Securities Markets*).

3.4.11. Educating Market Participants:

Investing in advanced cybersecurity and technology solutions is crucial to protect trading platforms and systems from hacking or manipulation attempts. Ensuring the integrity of trading infrastructure is essential for risk management. (*Report to the Congress: Impact of Technology on Securities Markets*, n.d.)

3.4.12. Market Surveillance:

Effective market surveillance is a proactive risk management strategy. Regulatory bodies and exchanges should invest in robust surveillance systems to detect unusual trading patterns and swiftly respond to potential manipulation. (Will, 2022)

In summary, risk management in the context of stock market manipulation involves a multifaceted approach that combines regulatory compliance, technology, surveillance, collaboration, and

education. By proactively identifying and mitigating risks associated with manipulation, financial markets can maintain their integrity and protect the interests of investors and participants.

Chapter 4
Conclusion

This comprehensive collection of research findings and studies underscores the critical issue of stock market manipulation and the various methods employed for its detection. The research represents how well unsupervised methods like Kernel Principal Component Analysis and Multidimensional Kernel Density Estimation, ensemble learning frameworks, and machine learning models like EML-AD perform in accurately recognizing manipulative actions. To preserve market integrity, they underline the significance of cooperation between regulatory entities like the National Securities and Exchange Commission and international organizations. The study also clarifies how stock-based incentives affect financial reporting and urges caution in the banking sector. It also highlights how important AI, proactive monitoring, and continuous research are for preventing fraud, improving investor protection, and upholding market trust. Overall, this research advances our knowledge of stock market manipulation and the methods for preventing it, providing regulators, investors, and financial institutions with useful information.

In conclusion, the propensity of the stock market to detect fraud has been substantially enhanced by technology advancements and academic achievements. A range of innovative tactics, including graph mining to artificial intelligence techniques, have provided a toolbox of weapons that effectively combat market manipulation. This development not only improves the integrity of the market but also encourages investor confidence. A climate that is healthier and more open for business is made possible by the confidence that illegal acts are being closely watched and dealt with. Future financial markets carry the possibility of better resilience and security for all participants as researchers push the limits of manipulation detection**.**

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