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Capital market reforms and market efficiency: case of the Nairobi Securities Exchange, Kenya.

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CAPITAL MARKET REFORMS AND MARKET EFFICIENCY: CASE OF THE NAIROBI SECURITIES EXCHANGE, KENYA

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

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ABSTRACT

The role and importance of stock markets globally and locally has led to significant efforts being put into ensuring growth of these markets. Key among these efforts include implementation of reforms within the stock markets with the aim of promoting market development. The Kenyan stock market has had several reforms implemented since the 1990s to date, however, there still remains a gap between expected market performance in comparison to the reforms that have been put in place. The objective of this study was to examine and assess market efficiency following implementation of capital market reforms at the Nairobi Securities Exchange (NSE). Specifically, the study intended to assess the stock market efficiency upon implementation of the following reforms: automated trading system reforms, Central Depository and Settlement (CDS) reforms and stock market demutualization reform at the NSE. The choice of the reforms is highly influenced by studies that have been done in the past for which results have been inconclusive or not previously researched. The underpinning theories guiding this study include the efficient capital markets theory, theory of over and under market reaction and theory of economic regulation. Empirical reviews were also done to build on existing methodologies from similar studies done previously. The study took an event study approach for each of the independent variables to determine how the markets reacted each time the particular reform was implemented. The study applied positivism given that quantitative data was analysed, and a purposive sampling technique was used to obtain data from the listed companies at the NSE. The study utilised secondary data obtained historically from the NSE. Data was analysed using Stata 14.0 and SPSS 23, and findings revealed strong positive correlation between automation reforms and market returns throughout both the short term and long-term event windows. Findings also reveal consistent significance of abnormal returns from zero, which is an indicator of market inefficiency; additionally, results reveal significant volatility across all their reforms upon implementation. In the case of CDS and demutualization reforms implementation the market was efficient as no autocorrelation was observed. However, in the case of automation reforms, there was negative autocorrelation pattern which is not consistent with efficient markets and thus in the period of automation of the NSE, the market experienced inefficiency. The findings of the study are intended to benefit various stakeholders including policy makers, sector practitioners and scholars. The study recommends that future studies consider research on reforms cutting across the East African region or comparative study with findings in local markets in comparison to more developed markets. Additionally, there is room to study more recent reforms that have been implemented in the local stock markets.

DEDICATION

I dedicate this research project to my family; your support, guidance and encouragement has made this project come to fruition.

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ABBREVIATIONS

AR	Abnormal Returns
ATS	Automated Trading System
CAPM	Capital Asset Pricing Model
CAR	Cumulative Abnormal Return
CDBL	Central Depository Bangladesh Limited
CDS	Central Depository System
CDSC	Central Depository and Settlement Corporation Limited
CMA	Capital Markets Authority
ETFs	Exchange Traded Funds
GARCH	Generalized Auto-Regressive Conditional Heteroscedasticity
GSE	Ghana Stock Exchange
LSDV	Least Squares Dummy Variable
NACOSTI	National Commission for Science, Technology and Innovation
NASI	NSE All Share Index
NSE	Nairobi Securities Exchange
SRO	Self-Regulatory Organization
WFE	World Federation of Exchanges

DEFINITION OF TERMS

Abnormal stock returns: the unanticipated profits (or losses) generated by a security/stock. Abnormal returns are measured as the difference between the actual returns that investors earn on an asset and the expected returns that are usually predicted using the CAPM equation. An abnormal return is the difference between the actual return of a security and the expected return.

Expected return: The expected return is the profit or loss that an investor anticipates on an investment that has known historical rates of return. It is calculated by multiplying potential outcomes by the chances of them occurring and then totalling these results.

Automated trading: a subset of electronic trading that relies on computer algorithms for decision-making and execution of order submissions.

Automated trading systems: also referred to as mechanical trading systems, algorithmic trading, automated trading or system trading — allow traders to establish specific rules for both trade entries and exits that, once programmed, can be automatically executed via a computer.

Capital markets: the part of a financial system concerned with raising capital by dealing in shares, bonds, and other long-term investments.

Capital markets reforms: Capital market reform allows capital markets to embrace new ideas and techniques that affect the capital market.

Dematerialization: can be defined as the conversion of share certificates owned by investors to electronic form maintained in an account with the Depository Participant or CDC account so as to allow electronic transactions

Demutualization: The process of converting a mutually owned organization into a private or publicly listed company. It is when a mutual company owned by its members converts into a company owned by shareholders.

Returns: Returns are price changes in an index or other security that may be captured by investors or traders as profits. “Market returns” as a general term may refer to price changes in the NASI or NSE 20 Share Index, a major benchmark of Kenyan stocks. The gain or loss realized from trading in a security for a given period of time.

Stock Market: is where investors buy and sell shares of companies. It's a set of exchanges where companies issue shares and other securities for trading.

Stock Market Capitalization: total market value of a company's outstanding shares of stock.

Market Reaction: a sudden but usually short-lived upwards or downwards movement in a stock's price.

NSE 20 Share Index: A price weighted Index calculated as a mean of the top 20 best performing counters.

NSE All Share Index (NASI): It is a market cap weighted index consisting of all the securities on the NSE.

The Central Depository System (CDS) is an electornic system which facilitates the faster change of ownership of securities traded electronically between parties, without the need for the movement of physical documents.

Trading: The action or activity of buying and selling shares.

Share turnover: a measure of stock liquidity, calculated by dividing the total number of shares traded during some period by the average number of shares outstanding for the same period.

Volume traded: Volume of trade is the total quantity of shares or contracts traded for a specified security. It can be measured on any type of security traded during a trading day. Volume of trade or trade volume is measured on stocks, bonds, options contracts, futures contracts, and all types of commodities.

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

The purpose and importance of the capital markets in countries' economic ecosystems has received increasing attention due to their significant contributions to overall economic growth. Observations have revealed that capital markets that are well-functioning increase nation's investment, growth and overall economic efficiency (Ngugi, Amanja, & Maana, 2006). Several countries have enacted reforms in their local capital markets with the aim of deepening markets and growing participation, although research reveals that performance still remains disappointing. Studies have revealed that outcomes post reform implementation have been varied, with many developing countries indicating minimal growth in comparison with most advanced nations. Other countries have been recorded to have dismal performance. Still, stock markets in developing countries remain highly illiquid and segmented with trading focussed on few stocks (Torre, Gozzi, & Schmukler, 2007).

The capital market is a platform of finance where the long-term debt or equity assured securities are the product for buying and selling. Furthermore, it is the source of financing for companies and the market for buying and selling equity and debt instruments (Parvez, Sarwar, Hoq, & Chowdhury, 2017). Stock and bond markets are of significant importance in that they improve intermediation of savings, strengthening of financial systems and providing long term financing to companies for growth while boosting savings for the traditional sector (Chimpango, 2017). Additionally, they enable mobilisation of domestic savings, enhancement of inflows of international capital as well as enabling of the government's privatization programmes (Nyasha & Odhiambo, 2014).

Given the importance of capital markets, both emerging and developing countries have put in place significant efforts to facilitate the growth and deepening of the sector. Over time, through the implementation of capital market reforms, there has been an evolutionary process from non-formal to formal markets and organizations with the establishment of regulatory and statutory bodies with the aim of enhancing investor protection and confidence, ensuring self-regulation of markets and revitalization of the entire systems (Ngugi, 2003) (Akamiokhor, 1996).

Globally, several countries have implemented reforms with the aim of boosting stock market development. A study by Torre, Gozzi, & Schmukler (2007) was conducted across several countries to determine the effects of reforms on stock market development as measured by capitalization, trading activity and capital raising. The study focussed on 6 reforms for which long term data was available for a large number of countries including: stock market liberalization, enforcement of insider trading laws, introduction of fully automated electronic trading systems, privatization programs, structural pension reform and institutional reforms. Findings revealed that reforms are associated with increases in domestic stock market capitalization, trading, and capital raising for majority of the countries in the study. However, findings in Kenya were inconclusive for Kenya for 4 reform indicators: enforcement of insider trading laws, introduction of electronic trading systems, institutional reform and pension reform. This presents a researchable area, given that since the period of research these reforms have been implemented in the Kenyan market. This paper also recommends further areas of research including understanding if the impact of reforms differs across countries and if differences in the timing of specific reforms affect their impact on stock market development and internationalization (Torre, Gozzi, & Schmukler, 2007).

1.1.1. Automated Trading Reforms

Automated trading refers to a subset of electronic trading that relies on computer algorithms for decision-making and execution of order submissions. According to Debysingh and Watson (2009), the aim of automating stock trading is to improve both operational and informational efficiency of an exchange. Automated markets provide more efficient discovery of prices due to lower trading cost, faster execution of trade and better capture of information thereby enhancing efficiency (Mwangi, 2015). A study on the effects of the Automated Trading System (ATS) on the efficiency of the Nairobi Securities Exchange (NSE) for the period 2013 to 2017 revealed a significant positive relationship between the ATS and efficiency of the NSE which further led to market efficiency and increase in the regularity of traders, easy access of the traders to their funds (Mwangi, 2019). Additionally, a study of the effects of automation for the period 2000 to 2012 on local stock market efficiency as measured by returns and volatility revealed that there was significant increase in market returns post-automation (Okumu, 2013). A similar study investigates the effects of automation on volumes traded at the NSE, between 2003 and 2009 revealing that that automation increased volume of companies' equities traded for majority of the 41 companies, during the period under investigation (Simiyu, Osero, & Odoyo, 2014). Furthermore, a

similar study also revealed that automation has positive effects on market microstructure-related characteristics of volume and volatility (Asewe, et al., 2013). A study on the effect of information technology on trade volumes and volatility on the Dhaka Stock Exchange revealed that the average of the trade volume and its volatility significantly increased (Ashraf & Joarder, 2009). A study on the possible effect of automation on the Zimbabwe Stock Exchange from an ex-ante position revealed that trading automation has statistically significant relationships with local market liquidity, volumes and value traded, price discovery process and local market regulation (Musimwa & Kaseke, 2016).

On the contrary, a study conducted in Kenya of the period pre-automation and post automation revealed that the introduction of the ATS had no statistically significant effect on market efficiency at the NSE as measured by stock market returns (Omuchesi, Bosire, & Muiru, 2014). Similarly, introduction of the ATS was found to have no statistically significant effect on trading volumes at the NSE (Mwangi, 2015). A study conducted in Ghana for the year 2008 revealed that there was no impact towards improving efficiency on the stock market post automation (Mensah, Pomaa-Berko, & Adom, 2012). Nyangara and Musikavanhu's (2014) study revealed that contrary to findings of numerous studies, automation of the stock market leads to reduction in trading volumes and listings, seemingly due to information efficiency effects on automation. The study also concluded that it is only over a long period of time that automation can have an effect on stock market performance.

Findings on the impact of automation on the NSE performance have been largely positive, while few have been neutral and negative in some cases. Notably, none of the studies have investigated the effects of automation on market returns through an event study. An event study can reveal greater market trends or patterns. If the same type of model is used to analyze multiple events of the same type, it can predict how stock prices typically respond to a specific event. Event studies also serve an important purpose in capital market research as a way of testing market efficiency (Kothari, Lewellen, & Warner, 2003). Additionally, all the studies above have been conducted before the most recent upgrade on the ATS which took place in 2019. There is an opportunity to investigate the impacts of the automation using the data around the window of the most recent upgade in the ATS of the NSE which took place in September 2019: The NSE launched a new trading system provided for by Millennium Technologies who are part of London Stock Exchange Group. (Nairobi Securities Exchange).

1.1.2. Central Depository System (CDS) Reforms

The CDS is an electornic system which facilitates the faster change of ownership of securities traded electronically between parties, without the need for the movement of physical documents. The CDS enabled simplified, swift and safe transfer of investors' value. (Okumu, 2013). Automation of the trading system usually either precedes or is preceded by the adoption of a Central Depository System (Omuchesi & Bosire, 2014).

A study analyzing the growth and development of Central Depository Bangladesh Limited (CDBL) revealed that the system led to a stable growth of listed securities in CDS, depository participants, settlement of securities transactions, documentation of CDBL, total assets and net income during the period of 2007-2015 (Chowdhury & Huda, 2017)**.** Likewise, dematerialization, has enabled the Indian Capital Market to grow exponentially as indicated by amount raised from the market, number of stock exchanges and intermediaries, number of listed stocks, market capitalization, trading volumes, turnover on stock exchanges and investors population (Garg, 2016). Additionally, following dematerialization of securities, there is a sizable increase in terms of number of investors' accounts, number of companies available for dematerialization, number of depository participants, number of depository participant service centers, number of Quantity of dematerialized shares or securities and number of dematerialized Value of Securities in CDSL. Numerous benefits have been noted following implementation of a CDS including improved efficiency of the Indian stock market (Kumar, 2020).

Following implementation of a Central Depository System (CDS) in the Mauritius Stock Exchange in January 1997, there was increased prompt, efficient clearing and settlement of trades and simultaneously abbreviated a number of the inherent risks in the process (Nowbutsing & Odit, 2009). In Kenya, a study on the implementation of the CDS in relation to the local stock market performance revealed that although insignificant, there was growth in the indicators measured during the period following implementation of the CDS. The indicators included market capitalization, market turnover, turnover ratio, shares traded and the number of transactions (Otuko, 2006).

Past research has revealed that stock markets in India, Bangladesh, Mauritius and Kenya have experienced growth across several stock market indicators following the implementation of CDS. So far, none of the studies have had conflicting findings and notably, none of the

studies have taken an event study approach leaving room for investigation of the effects of CDS reforms from this perspective.

1.1.3. Demutualization Reforms

Demutualization is the process of converting a mutually owned organization into a private or publicly listed company (Bousetta, 2017). Demutualization induces a change in the stock exchange's objectives from managing interests of a closed member-based organisation - with the central focus on providing benefit primarily of the member/brokers and keeping costs of investments limited to financing needs of members - into a company set up with the objectives of maximizing the value of investment by focusing on generating profits from servicing the demands of their customers (brokers, listed companies and investors) in a competitive manner. The exchanges that have demutualised have done so because they found that their mutual governance structure, which once served them well, had become a hindrance to positioning themselves competitively in a global trading environment. Demutualization is typically followed by self-listing of the exchange (Islam & Islam, 2011). With regards to demutualization and stock market performance studies have revealed varying effects. Empirical evidence has revealed that demutualized exchanges perform relatively poor as far as productivity growth is concerned. There was no evidence that publicly listed exchanges possess higher efficiency and productivity values than demutualized exchanges with a customer-dominated structure (Serifsoy, 2008). A study of demutualised stock exchanges that are members of the World Federation of Exchanges (WFE) and had demutualised between 1993 and 2004 revealed that demutualization programmes do not improve market performance of the equity and bond markets for all 16 indicators tested in the study. In this study significant positive effects were noted for only 7 of the indicators: total number of listed companies, number of transactions, domestic market capitalization, and capital raised by domestic companies, total value of share trading, turnover velocity of domestic shares and value of bonds listed (Morsy & Rwegasira, 2010).

In a later study empirical findings from 11 out of 20 demutualized stock exchanges during the period from 1996 to 2008, revealed that demutualization increases an exchange's financial performance, size, and liquidity thus it is a value enhancing process for both the exchange and its shareholders (Azzam, 2010).

A study assessing the effects on demutualization on financial performance measured by returns on assets, equity and investments revealed significant impacts (Mwangi, 2011).

Findings from a study on effects of demutualization on the London and Hong Kong Stock Exchanges revealed that demutualized stock exchanges hold a stronger operating performance and a better performance in term of shareholder's return than mutual exchanges (Altaf, 2009). A study on 13 stock exchanges that are members of the WFE revealed that stock exchanges are performing better in all levels of economies after the demutualization in many dimensions except in number of transactions in low level economies (Sial, Tahir, Zulfiqar, Iqbal, & Naqvi, 2014). Additionally, change in the objectives of stock exchanges, change in the governance structure and change in the ownership of stock exchanges significantly fosters stock market growth in terms of number of listed companies, number of transactions in equity market, stock index, and market capitalization (Alam, Sial, Talib, & Ashkanani, 2015).

The studies mentioned above are conducted on developed markets between 1993 and 2009, while an additional study published in 2014 focussed on WFE member exchanges, of which the NSE was not a member during that period under investigation. While Mwangi (2011) study is conducted on the local markets, it solely focussed on financial performance. The NSE demutualised in 2014, which shows that there is an opportunity to conduct a study of demutualization on non-financial performance metrics, specifically market efficiency.

1.1.4. Historical Highlight of Reforms in the Kenyan Capital Markets

The reforms process locally dates back to the 1980s when the Government of Kenya realized the need to design and implement policy reforms to ensure efficient and stable financial systems. Recommendations from the 1984 International Financial Corporation /Central Bank of Kenya study recommended reforms including diversification of money market instruments, creating favourable tax policies, establishment of a regulatory authority, all with the overall effect of improving price discovery, enhancing competition, reducing financing costs and enhancing liquidity (Ngugi, 2003).

The Capital Markets Authority (CMA) was established and inaugurated in 1990, with the main aim of promoting and facilitating the development of an orderly and efficient local capital market system. In 1991, the Nairobi Stock Exchange (NSE) was registered under the Companies act and moved to the floor based "Open-Outcry System", reducing settlement time. In the same year, efforts were made to reduce listing costs and implement favourable tax policies for shares, debentures and bonds. Later, in 1995, an amendment was made to the act to provide for foreign investor participation as part of the revitalization process. In the

same year, the investor compensation fund was set up to compensate traders for financial losses arising from failure of dealers to meet contractual obligations. 2 years later in 1997, in a bid to facilitate diversity of financial assets traded in the market, guidelines for issuance of corporate bonds and commercial paper were issued. In 1998, the CMA published new guidelines on disclosure standards by listed companies. In 1999, the CMA also issued guidelines to promote good corporate governance practices by listed companies (Ngugi, 2003).

In March 1999, the Central Depository and Settlement Corporation Limited (CDSC) was formed with the aim of enhancing liquidity of the stock market and efficiency of trading through the reduction of delivery period and settlement, through the subsequent implementation of the Central Depositing System (CDS).

Additional reforms in 2000 – 2001 saw the introduction of tax concessions of 50% for newly listed companies for five years, provided the firm listed a minimum of 30% of its full issued and authorised share capital on the NSE, such that the newly listed companies paid a corporate tax of 25%, as compared with 30% for the unlisted firms. New and expanded share capital by listed companies for those seeking listing was exempted from stamp duty. Expenses incurred by companies in having their financial instruments rated by an independent rating agency were made tax deductible.

In 2006, an electronic trading system replaced the "open- outcry" method in an effort to boost trading volumes and to speed up transaction times. In the same year The Exchange began operating an Automated Trading System (ATS), designed to electronically match buy and sell orders in a transparent process that involves member firms of the NSE placing bids and asking prices in a centrally accessible electronic order book.

In 2014 The Nairobi Securities Exchange received formal approval from the Capital Markets Authority (CMA) to operate as a demutualized entity which culminated in listing of its own shares. Following its self-listing the Exchange becomes the second African Exchange after the Johannesburg Stock Exchange to be listed. Following these reforms, Kenya's capital market has developed significantly in terms of market capitalisation, the total value of stocks traded, and the turnover ratio (Nyasha & Odhiambo, 2014). (Torre, Gozzi, & Schmukler, 2007)

In 2016 the NSE received formal recognition as a Self-Regulatory Organization by the Capital Markets Authority Further along in 2017; the NSE became the first Exchange in the East African region to introduce Exchange Traded Funds (ETFs) and subsequently listed the Barclays New Gold ETF (Nairobi Securities Exchange, 2021).

1.2. Statement of the Problem

Capital market reforms are implemented to enable growth, dynamism and deepening of the stock markets, however,the impact of these market reforms sare still yet to reflect the purpose for which they were implemented. Studies and reports have also revealed that in spite of reforms being implemented the local stock market is still not at its optimum as indicated by weak local participation in the markets, low trading volumes, high risk of capital flight and low investor confidence in the markets. With over 2 million investor accounts registered at the CDSC, approximately only 3 per cent of these accounts are active, which is dismal compared with developed stock markets like the US stock markets where participation in the markets is up to 90 per cent of the population. Typically, demutualization is intended to improve the product offering at the stock market while enabling a wider reach to the market and improved participation, whereas this reflection has been negligible in the local markets with a narrow product offering mainly centred on equity and bond offerings, while developed markets such as the Australian Stock market have hundreds of product offerings for the market player to tap into. (Munene, 2018) (Capital Markets Authority, 2022).

Further, a study by Torre, Gozzi, & Schmukler (2007) on capital market development reveals enforcement of insider trading laws, introduction of electronic trading systems, institutional reform in relation to various stock market indicators was inconclusive in Kenya, thus presenting a case for building on the findings of that study. Building on this study would be instrumental in revealing the findings of implementation of the reforms, and also which reforms tend to have the most significant impact on market efficiency. Without this information it would be difficult for stock markets to determine which reforms have the most significant impact on markets. Several reforms have been implemented over time, but there is little evidence that points towards the reforms that have had the most significant impact on the market.

With the key purpose of stock market reforms being to accelerate growth of the stock markets and increase returns on investments thus leading to a vibrant and efficient stock market, there

still remains a chance to investigate the effectiveness of the reforms that have been implemented in the stock market, especially in relation to market efficiency which refers to the degree to which market prices reflect all available, relevant information such that all information is already incorporated into prices.

Studies on effects of ATS on the stock market have revealed mixed findings. Some have revealed positive effects on various stock market indicators (Mwangi, 2019) (Okumu, 2013). (Simiyu, Osero, & Odoyo, 2014) (Asewe, et al., 2013) (Ashraf & Joarder, 2009) (Musimwa & Kaseke, 2016). Contrarily, some studies show no effect on the market following implementation of ATS (Omuchesi, Bosire, & Muiru, 2014) (Mwangi, 2015) (Mensah, Pomaa-Berko, & Adom, 2012) A negative effect on ATS implementation was noted by Nyangara and Musikavanhu's (2014) study. However, a gap exists where there is a posibility to examine the stock market efficiency as a result of most recent ATS upgrade on the NSE which occurred in 2019.

Implementation of the CDS is largely followed by positive growth as noted in several studies (Chowdhury & Huda, 2017) (Garg, 2016) (Kumar, 2020) (Nowbutsing & Odit, 2009) (Otuko, 2006). Studies on impact of market reforms to CDS effects on the local market are inconclusive.

With regards to demutualization and stock market performance studies have revealed varying effects including neutral (Serifsoy, 2008) (Morsy & Rwegasira, 2010) and positive (Morsy & Rwegasira, 2010) (Azzam, 2010) (Mwangi, 2011) (Altaf, 2009) (Sial, Tahir, Zulfiqar, Iqbal, & Naqvi, 2014) (Alam, Sial, Talib, & Ashkanani, 2015) The NSE demutualised in 2014, which shows that there is an opportunity to conduct a study of demutualization on non-financial performance metrics in this case, market efficiency. The core gap that this study aims to contibute to is the assessment of the 3 reforms in a single research, which would essentially enable comparison for the different reform implementations.

1.3. Research Objectives

1.3.1 General Objective

To assess the stock market efficiency based on capital market reform implementation at the Nairobi Securities Exchange, Kenya.

1.3.2 Specific Objectives

i. To assess stock market efficiency upon ATS reform implementation in the NSE;
ii. To examine stock market efficiency based on CDS reform implementation in the NSE;
iii. To investigate stock market efficiency upon demutualization of the NSE.

1.4. Research Questions

i. How was market efficiency impacted upon implementation of the ATS reforms at the NSE?
ii. How was market efficiency impacted upon implementation of CDS reforms at the NSE?
iii. How was market efficiency impacted upon demutualization of the NSE?

1.5. Scope of the Study

This study is focused on the Kenyan Capital Markets reforms that have taken place between 1999 and 2019 including implementation of the CDS in 1999, implementation of the ATS upgrade in 2019 and demutualization of the NSE in 2014. Uniform to all these reforms is their sole aim of enhancing trading efficiency, reducing delivery and settlement time, boosting trading volumes and enhancing investor protection, all of which are important basis and stimuli for investor participation and overall growth of the local stock markets (La Porta, Lopez-de-Silanes, Shleife, & Vishny, 2000) (Nyasha & Odhiambo, 2014). The selection of the 3 reforms is also largely informed by studies that have been done in the past, where the researcher was keen to select reforms for which studies have been inconclusive or not researched in past studies. The researcher was also keen to select reforms for which stock market data was available during the period in which the reforms took place.

While capital markets typically feature the trading of the following securities: stocks, bonds, forex, commodities and derivatives, (Aduda, Chogii, & Murayi, 2014) this study will focus on stocks given that these are what are primarily traded on the NSE primary market and for which data for the periods sought will be readily available (Nairobi Securities Exchange, 2021). An ideal way to assess the impact of reforms is to carry out event studies to each reform, is to look at relevant market indicators before and after the particular reform has been implemented and make a judgment as to whether things improved or became worse (Gokarn, 1996). The study seeks to look at impact of the various reforms independently and then compare the effects across board with the aim of establishing impacts of each reform. The

study will thus seek to conduct event studies on each reform as highlighted above to assess the market efficiency following implementation of the various reforms.

1.6. Significance of the Study

1.6.1 Policy Makers (Government)

This research will be of value to policy makers, including the Government by pointing out the kind of reforms that should be prioritized within the capital markets. Policy makers will be equipped with data and information which can assist in guiding on the kinds of laws and regulations that should be prioritized to boost market activity. The available information suggests that policymakers should remove impediments to stock markets, such as tax, legal, and regulatory barriers. Future research could focus more on what policies appropriately facilitate healthy stock market development (Levine & Demirguc-Kunt, 1996).

1.6.2 Stock Market Practitioners

African practitioners within the stock market including stockbrokers, investment banks and other market intermediaries could pointedly boost their growth trajectories by applying the outcomes of the study. Ensuring the implementation of changes which have a positive impact on market growth, will also have a positive effect on these businesses as their profits are pegged on market performance. World capital markets are booming, and emerging capital markets account for a disproportionate share of this growth. (Levine & Demirguc-Kunt, 1996) Undeniably, the contribution of capital markets in the creation of financial inclusivity cannot be overlooked and a vibrant and developed stock market is an important determinant of economic development in advanced and advancing economies (Gworo, 2020) and reforms in product markets seem to be an essential element of any ‘‘agenda for growth” (Nicoletti & Scarpetta, 2006).

1.6.3 Scholars

Based on the above, this study will this seek to contribute to existing literature by investigating which policies or reforms contribute to the development of a robust and inclusive market. Scholars stand to benfit from the study by progressing on research gap that will be identified at the end of the study. Additionally, the same model utilised in the study could be applied in a different geographical location to test for outcomes within and across different countries or regions (Torre, Gozzi, & Schmukler, 2007).

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This section seeks to understand the historical framework of the study which will inform and guide the relationship between capital market reforms and stock market efficiency. The chapter starts with the theoretical review that helps to explain the background and contextual relevance of the variables and the relationship between these variables. Additionally, the empirical review will present studies that have been carried out on markets reforms in relation to various market performance indicators. In conclusion, the section will highlight the key points from the literature review and highlight the gaps that this study will seek to fill.

2.2. Theoretical Literature

A multi-theoretical approach has been utilised in this study to ensure that all variables in the study are well addressed by an underlying theory that supports their application in the study. The theories applicable in the case of this study are multiple and the ones highlighted here include efficient capital market theory, theory of over and under market reaction and theory of economic regulation. At the conclusion of this chapter the researcher narrows down to the theories that are most applicable for this study in particular.

2.1.1. Efficient Capital Market Theory

First proposed by Eugene Fama in 1970, the efficient capital markets theory stipulates that capital markets are considered to be efficient when the price of the relative security accurately mirror the macroeconomic conditions related to that particular security, which are well known to the general public. This theory further postulates that the prices adjust according to the changes that directly affect these securities (Fischel, 1978).

Financial markets have been found to be efficient given that most of the firms and investors have access to the necessary and most basic information relating to any particular stock market. However, for these markets to be allocationally efficient there is need for external and internal efficiency. A stock market considered externally efficient when the information about the prevailing market conditions is widely and quickly disseminated thereby allowing the security prices to adjust accordingly to the new set of information hence reflecting the value of the investment. Internally efficient market, on the other hand, describes those stock markets where dealers and brokers compete fairly such that the cost of transactions becomes relatively low while the speed of transactions in the market is high (Sharpe, 2009).

Timmermann and Granger (2004) critique this theory by highlighting that one must inquire how each particular variable is suitable in predicting profitability of a given stock. They argue that the original definition of the efficient market hypothesis does not debate how data variables are used to produce actual forecasts. They argue that stable forecasting methods portended by this theory would, in the long run, self-distract when investors discover patterns, hence the need for more formal approaches to forecasting.

They therefore build on the original definition of efficiency market hypothesis as follows: "A market is efficient with respect to information set Q_t, search technologies S_t and forecasting models M_t, if it is impossible to make economic profits by trading on the basis of signals produced from a forecasting model M_t defined over predictor variables in the information set Q_t and selected using a search technology in S_t." (Timmermann & Granger, 2004).

Titan (2015) supports this approach to the efficient market theory by stipulating that due to the changes in economic circumstances, new models could be formulated to account for all the differences, due to the fact that testing for market efficiency is considered challenging.

Yalçın (2010), argues from the point of view that markets are rational and provide correct pricing. He argues that observed market anomalies including volume, volatility, cash dividends, equity premium puzzle and predictability, have a challenge for the argument for the efficient market theory. He argues that unreasonable speculations and the chances for arbitrage being limited in markets cause some irregularities that are unrealiable compared to the efficient market theory.

This theory support the objective of this study given that whenever a market reform is introduced it is usually announced to the market and the information on the reform including the implementation date is widely shared to all market stakeholders. Based on this, market stakeholders can then react to the information on the market reform, whereby on the date that the reform is implemented, they are able to act accordingly which then causes the prices to mirror the information surrounding the stock. Therefore, in the case of this study, whenever the automation, CDS and demutualization reforms were implemented, the market stakeholders reacted to this, causing the market prices to mirror these reactions, given that the reforms had a direct impact on the listed securities at the respective periods under review.

2.1.2. Theory of over and under reaction

Stock market overreacts to information in past earnings and/or security prices, at the expense of longer-run trends. As a result of this, investors can earn abnormal profits in longer horizon by buying up undervalued stocks and selling overvalued stocks. An investigation on the relationship and link between the market behaviour and psychology of individual decision making revealed most people "overreact" to unexpected and dramatic news events. (De Bondt & Thaler, 1987)

DeBondt and Thaler (1987) assumed that the risk level does not change between portfolio formation and test period. However, (Chan, 1988), (Ball & Kothari, 1989) have argued that the prior performance does change the risk of winner and loser firms and the risks does not remain constant over the period of time. Ball and Kothari (1989) argued that both winner and loser portfolio experiences large changes in market value during the rank period. He argued that the stocks with the series of negative abnormal returns will experience an increase in their equity betas and thus increased expected returns.

Jones (1993) reconciled the work of DeBondt and Thaler (1985, 1987), Chan (1988) and Ball and Kothari (1989) and suggested that the simple leverage effect as reported by Chan (1988) could not account for the positive covariance. Instead, the evidence of overreaction could be attributed to the pattern of market movements. Zarowin (1990) proposed that it is the differential size that drives the Winner vs. Loser phenomenon rather than the assumed investor overreaction. (Maheshwari & Dhankar, 2014)

The basic evidence of under reaction is that stock prices seem to respond to earnings for about a year after they are announced. The momentum effect identified by Jegadeesh and Titman (1993), using Capital Asset Pricing Model (CAPM) as the benchmark model is generally considered to be the leading study in explaining under reaction. The idea of momentum refers to the fact that stocks with high returns over the past year tend to have high returns over the following three to six months. The under-reaction idea implies that relative strength strategies (RSS) which is a trading strategy based on buying past winners and selling past losers would create abnormal returns.

Conrad and Kaul (1998) suggest that momentum profits are attributable to cross-sectional differences in unconditional expected returns rather than to any time series dependence in returns based on empirical tests supported by simulations and bootstrap experiments. Moskowitz and Grinblatt (1999) present evidence that the profitability on momentum

investment strategies significantly get smaller if we control for the effects of industry momentum on returns.

Grundy and Martin (2001) present further evidence in favour of momentum for the post 1926 era. Their contribution to the existing literature is that they showed industry effects or cross-sectional differences in expected returns are not the primary cause of momentum phenomenon. They show that the risk-adjusted profitability of momentum strategy is stable across periods. Their results suggest that we can build a profitable dynamically hedged momentum strategy. (Yılmaz, 2016)

This is a guiding theory for this study given that during the introduction of the automation, demutualization and CDS reforms, the expectation is that the market would either overreact, under react or react normally. This theory is thus a guide to know what the over or under reaction would look like and then proceed to deduce the impact of the respective reactions as per the reform that was implemented. This will be informed by the market reaction during the various event windows under study as further elaborated in the research findings section.

2.1.3. Theory of Economic Regulation

First put forward by Stigler in 1971, this theory states that application of laws by government to various institutions is intended at improving economic status of various economic groups. (Stigler, 1971) Two theories of economic regulation have been put forward including "public interest" theory, which holds that regulation is supplied in response to the demand of the public for the correction of inefficient or inequitable market practices.

The second theory is the "capture" theory which holds that regulation is supplied in response to the demands of interest groups struggling among themselves to maximize the incomes of their members. Arguments in support of this theory include the fact that it gives market participants more rights thus improving their quality of life. Contrasting this, economic regulation drives up costs and pushes up prices, which then leads to suppressed market participation. (Posner, 1974)

When government releases an Act, it directly influences the economic analysis of the capital market through various stock market indicators. This theory is timely in explaining the objectives and variables utilised in this study, given that where reforms on automation, demutualization or CDS reform were introduced, the government, through the market

regulator was aiming at protecting the stakeholder interests with the aim of enabling them to enjoy favourable market conditions.

Following the above elaboration of theories, the researcher settles on two major guiding theories including the efficient capital market theory and theory of over and under market reaction. There exists unusual occurrence or abnormality in smooth patterns of stock markets. Where efficient capital market theory has been unable to explain the existence of such anomalies, the market over and under reaction theory comes in to explain this. In the event that a market reform is implemented the window under review is expected to reveal the market reaction to the reform implementations namely automation, demutualization and CDS reforms. The efficient capital markets theory was useful in explaining the background on functioning of an effective stock market system. This theory is also used to explain the outcome of reforms under investigation including the automation, demutualization and CDS reforms implemented; such that where the reforms are implemented, this information is widely available to the market and the market prices then adjust to reflect this information, consequently impacting on the market returns.

2.3. Empirical Review

The empirical review will present studies that have been carried out on markets reforms in relation to various market performance indicators.

2.3.1 The Influence of ATS Reforms Implementation on Stock Market Efficiency

Torre, Gozzi and Schmukler (2007) conducted research across several countries to determine the effects of reforms on stock market development as measured by capitalization, trading activity and capital raising. Utilising the least squares regression method and considering a ten year event window around the reform dates, findings in Kenya were inconclusive for Kenya for 4 reform indicators: enforcement of insider trading laws, introduction of electronic trading systems, institutional reform and pension reform.

Mensah, Pomaa-Berko and Adom (2012) sought to establish the impacts of automation on the Ghana Stock Exchange (GSE) while Mwangi, 2013 and Omuchesi, Bosire and Muiru (2014) conducted a similar study in Kenya.

Utilising the Unit Root Random Walk and GARCH models, results revealed that the GSE was weakly inefficient in periods both pre and post implementation of the automated system,

revealing that automation did not improve efficiency at the GSE. (Mensah, Pomaa-Berko, & Adom, 2012) In a different study, a t-test found no difference between in returns that could be attributed to the operation of the automated trading system at 0.05 level of significance with the abnormal returns after automation as compared to situation before automation being almost non-existent. (Omuchesi, Bosire, & Muiru, 2014) Utilizing the Least Squares Dummy Variable (LSDV) Model to investigate the effects of automation on stock exchange performance, the study reveals that automated exchanges exhibit less trading activity than non-automated exchanges after controlling for other factors (Nyangara & Musikavanhu, 2014). Using descriptive research design, Mwangi (2019) revealed that efficiency improved significantly and there was increase in regularity of trades, easy access to funds and increase in the trading volumes.

Various studies have measured stock market efficiency using varied indicators including by returns and volatility (Okumu, 2013), volumes traded (Simiyu, Osero, & Odoyo, 2014) volumes and volatility (Asewe, et al., 2013), market liquidity, value traded, price discovery process and local market regulation (Musimwa & Kaseke, 2016). There is still room for investigation of automation reforms implementation on market efficiency in the Kenya context through an event study.

2.3.2 The Influence of CDS Reforms Implementation on Stock Market Efficiency

A study analyzing the growth and development of Central Depository Bangladesh Limited (CDBL) revealed that the system led to a stable growth of listed securities in CDS, depository participants, settlement of securities transactions, documentation of CDBL, total assets and net income during the period of 2007-2015 (Chowdhury & Huda, 2017)**.** Likewise, dematerialization, has enabled the Indian Capital Market to grow exponentially as indicated by amount raised from the market, number of stock exchanges and intermediaries, number of listed stocks, market capitalization, trading volumes, turnover on stock exchanges and investors population (Garg, 2016). Additionally, following dematerialization of securities, there is a sizable increase in terms of number of investors accounts, number of companies available for dematerialization, number of depository participants, number of depository participant service centers, number of Quantity of dematerialized shares/securities and number of dematerialized value of Securities in CDSL. Numerous benefits have been noted

following implementation of a CDS including improved efficiency of the Indian stock market (Kumar, 2020).

Following implementation of a Central Depository System (CDS) in the Mauritius Stock Exchange in January 1997, there was increased prompt, efficient clearing and settlement of trades and simultaneously abbreviated a number of the inherent risks in the process (Nowbutsing & Odit, 2009). In Kenya, a study on the implementation of the CDS in relation to the local stock market performance revealed that although insignificant, there was growth in the indicators measured during the period following implementation of the CDS. The indicators included market capitalization, market turnover, turnover ratio, shares traded and the number of transactions (Otuko, 2006).

Past research has revealed that stock markets in India, Bangladesh, Mauritius and Kenya have experienced growth across several stock market indicators following the implementation of CDS. So far, none of the studies have had conflicting findings and notably, none of the studies have taken the approach of analysing these three key reforms in one study.

2.3.3 The Influence of Demutualization Reforms on Stock Market Efficiency

Empirical evidence has revealed that demutualized exchanges perform relatively poor as far as productivity growth is concerned. There was no evidence that publicly listed exchanges possess higher efficiency and productivity values than demutualized exchanges with a customer-dominated structure (Serifsoy, 2008). A study of demutualised stock exchanges that are members of the World Federation of Exchanges (WFE) and had demutualised between 1993 and 2004 revealed that demutualization programmes do not improve market performance of the equity and bond markets for all 16 indicators tested in the study. In this study significant positive effects were noted for only 7 of the indicators: total number of listed companies, number of transactions, domestic market capitalization, and capital raised by domestic companies, total value of share trading, turnover velocity of domestic shares and value of bonds listed (Morsy & Rwegasira, 2010).

In a later study empirical findings from 11 out of 20 demutualized stock exchanges during the period from 1996 to 2008, revealed that demutualization increases an exchange's financial performance, size, and liquidity thus it is a value enhancing process for both the exchange and its shareholders (Azzam, 2010).

A study assessing the effects on demutualization on financial performance measured by returns on assets, equity and investments revealed significant impacts (Mwangi, 2011). Findings from a study on effects of demutualization on the London and Hong Kong Stock Exchanges revealed that demutualized stock exchanges hold a stronger operating performance and a better performance in term of shareholder's return than mutual exchanges (Altaf, 2009). A study on 13 stock exchanges that are members of the WFE revealed that stock exchanges are performing better in all levels of economies after the demutualization in many dimensions except in number of transactions in low level economies (Sial, Tahir, Zulfiqar, Iqbal, & Naqvi, 2014). Additionally, change in the objectives of stock exchanges, change in the governance structure and change in the ownership of stock exchanges significantly fosters stock market growth in terms of number of listed companies, number of transactions in equity market, stock index, and market capitalization (Alam, Sial, Talib, & Ashkanani, 2015). There is room for an investigation on the three key reforms to be done in the Kenyan context.

2.4. Literature Review Summary and Research Gaps

This section presents a summary of the literature review studies on reforms that have been done in the past including the findings from the various studies and indication of the gaps arising from the studies and how this study will attempt to fill the gaps. The table presented under appendix I reviewed the various gaps that were identified in the empirical review of the various studies in line with the research objectives.

Several studies have investigated effects of automation on market efficiency as measured by various variables including trading activity, capitalization and capital raising. Findings have revealed differing results. Findings were inconclusive in Kenya for the periods under study, though later studies revealed no significant effect and a conflicting study revealed improved efficiency at the NSE. Notably, these studies were carried out in the period following the first implementation of the ATS at the NSE and none have looked into the effects on market efficiency following the most recent ATS reforms which saw a major upgrade in the system and which took place in the year 2019.

Looking at the findings on CDS reforms, various studies have been done withing different markets revealing differing results across a wide array of market indicators. Analyzing the growth and development of CDBL revealed that the system led to a stable growth of listed

securities in CDS, depository participants, settlement of securities transactions, documentation of CDBL, total assets and net income during the period of 2007-2015. Additionally, CDS implementation in the Indian Capital Market grew exponentially as indicated by amount raised from the market, number of stock exchanges and intermediaries, number of listed stocks, market capitalization, trading volumes, turnover on stock exchanges and investors population. Additionally, there is a sizable increase in terms of number of investors' accounts, number of companies available for dematerialization, number of depository participants, number of depository participant service centers, number of Quantity of dematerialized shares or securities and number of dematerialized Value of Securities in CDSL. In the Mauritius Stock Exchange, there was increased prompt, efficient clearing and settlement of trades and simultaneously abbreviated a number of the inherent risks in the process. This reveals inconclusiveness in the Kenyan context, with no study in particular investigating the impact of CDS implementation on market efficeincy in the NSE.

Findings on the impacts of demutualization on market indicators have been varied. One study revealed that there was increase in size, liquidity and performance of the market, however another study revealed poor productivity growth post demutualization. Another study that took 16 market indicators, revealed that only 7 indicators, including total value of shares traded improved post demutualization. At the NSE, it was found that demutualization improved financial performance; notably, this points out a mutual gap and recommends testing effects of demutualization on non financial metrics including market returns.

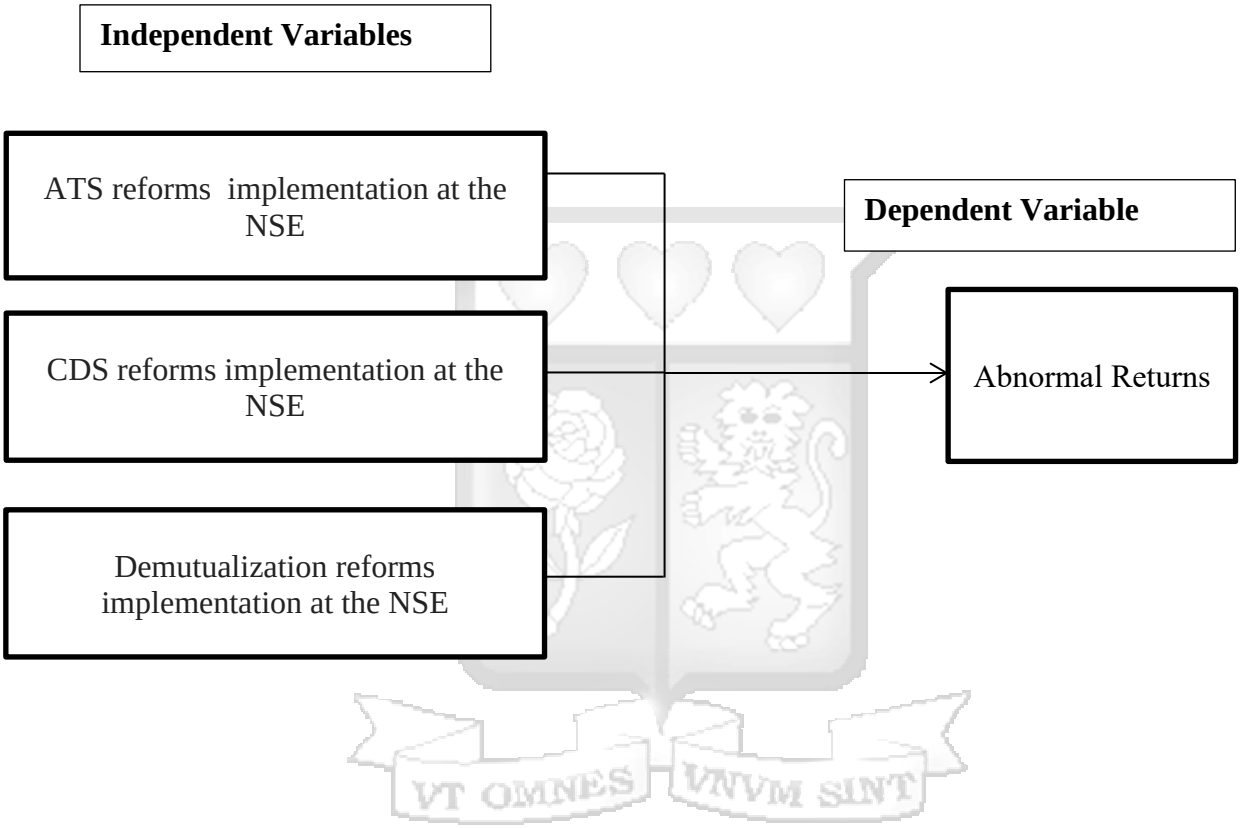
The emerging gap is the opportunity to investigate the effects of implementation of the 3 market reforms in this study in relation to market efficiency, which gives ability to compare the findings across the three reforms in one study.

2.5. Conceptual Framework

The conceptual framework captures 3 variables as the independent variables: Automated Trading System, Demutualization and Central Depository System, in relation to the dependent variable which is the market efficiency as measured by abnormal returns. The framework aims to support the objective of the study by showing the relationship between the various reform implementations and market efficiency. Given that the event study approach is used, the dependent variables identified will be observed over a period of time, pre and

post reform, in relation to the dependent variable. This study excludes control variables given that they do not change on a daily basis, however the study intends to run regression for a few days with daily data; whereas control variables would have static values over a given period, say quarterly or yearly, thus distorting the results of the regression. (Torre, Gozzi, & Schmukler, 2007) (Obadha, 2019).

Figure 1: Conceptual Framework



CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

This chapter will look into the techniques that the researcher used to respond to the research objectives. It will highlight in the research design, population and sampling techniques, methods of data collection and data analysis. It will also highlight on research quality assurance and ethical considerations throughout the research process.

3.2. Philosophical Framework

Creswell (2014) highlights various philosophical approaches or assumptions that have been utilised by various researchers including epistemology, methodology, ontology and axiology. He highlights that these approaches further incorporate realism, relativism, positivism and interpretivism. The researcher proposes to use the positivism method given that the data to be employed is quantitative. This entails a philosophical system recognizing only that which can be scientifically verified, or which is capable of logical or mathematical proof. This is applicable to this study as the researcher will aim to scientifically establish the impacts of implementation of reforms in the stock market. (Caldwell, 1984).

The study will aim to gather already known data from authoritative sources within the capital markets primarily including the NSE. The study will aim to maximise on secondary data. The study aims to use deductive methods moving from already existing theories in order to create an empirical framework, findings of which will either support or refute existing theories earlier mentioned (Creswell, 2014).

3.3. The Research Design

Research design is a blueprint for data collection, measurement and analysis in a manner that addresses the objectives of the study (Sekaran & Bougie, 2013). Correlational research design was used through event study methodology. Event study methodology is a direct test for correlation in determining the effects of reforms and regulation on stock returns. The event study methodology was used in this study to capture informative announcements and to estimate daily abnormal returns over time. The event study design indicates the information content and the behaviour of information asymmetry around regulation implementation. This study is an inference of correlational study where reforms are expected to cause change on stock prices. Abnormal returns will be computed as the sum of daily abnormal returns realized in the event period constituting of 210days prior to the regulation and 210 days subsequent to the regulation event day. The two events periods were compared to find out if

they are significantly different from zero to signify the reform information which was impounded immediately to conform to the market efficiency hypothesis. The aim to determine the relationship between the dependent variable, as measured by market return and independent variables as identified and provided in the conceptual framework. This research design is relevant to this study as it aims to assess the impact on market efficiency following the implementation of the 3 reforms namely automation of the Exchange, implementation of a CDS and demutualization of the Exchange.

3.4. Population and Sampling

The target population for the study is the 69 listed companies on the NSE. The study will aim to select the companies that were listed during the period under review as per each reform, after which purposive sampling will be used to select companies that have were listed and trading during the period in question.

Table 1: Listed Companies by Periods

Listing period	Companies
2000s – 2010	I&M Holdings Ltd, Atlas Africa Industries Ltd, Deacons (EA) Ltd, Longhorn Publishers Ltd, Nairobi Business Ventures, Umeme Ltd, Britam Holdings Plc, CIC Insurance Group Ltd. Home Afrika Ltd, Kurwitu Ventures Ltd. Trans Century Ltd, NSE Plc, Stanlib Fahari I-REIT, Flame Tree Group Holdings Barclays New Gold ETF
2010 – 2020s	HF Group Ltd, Nat. Bank of Kenya Ltd, Kenya Airways Ltd, Sameer Africa Ltd, TPS Eastern Africa, Uchumi Supermarkets Ltd, Crown Paints Kenya Ltd, ARM Cement Ltd, Equity Group Holdings, Co-operative Bank of Kenya, Eveready East Africa, WPP Scan group Ltd, Kengen Co. Ltd, Kenya Re Insurance Corporations Ltd, Liberty Kenya, Mumias Sugar Co. Ltd, Safaricom Ltd, Laptrust.

3.5. Data Collection Methods

Secondary data will be utilised in the study. Data on the daily stock prices will be obtained primarily from the NSE. The nature of data to be collected is daily share prices and daily index performance (NSE All Share Index (NASI) returns and NSE 25 Share Index Returns)

3.6. Data Analysis and Presentation

The researcher took an event study methodology, which is a useful method for testing market efficiency, namely by return analysis on the occurrence of an event, before and after the implementation of the event, for the purpose of assessing whether or not the event has led to an excess return (abnormal return). The data for this study consisted of past series of daily security prices of NSE quoted companies sampled, daily stock market indexes.

The event dates for this study will be taken respectively depending on when the reforms were introduced and operationalized, as below:

CDS - November 10, 2004: The central depository system was commissioned. For the first time in Kenya's history, the process of clearing and settlement of shares traded in Kenya's capital markets was automated.

Demutualization - June 27, 2014: The Nairobi Securities Exchange (NSE) received formal approval from the Capital Markets Authority (CMA) to operate as a demutualized entity. This is after the approval of the NSE's final application which met the regulator's requirements as stipulated in Section 5(3) of the Capital Markets (Demutualization of the Nairobi Securities Exchange) Regulations 2012.

Automation – September 26, 2019: The NSE implemented an upgrade on its own automated trading systems trading equities – the first to happen since 2006 when automation happened. This study focussed on the major upgrade to the ATS given extensive studies that had already been done on implementation of automation in 2006.

Research using the event study method involves two periods of time, namely the estimation period and the event window. Borrowing from Anintyarini & Utama, 2018, the event window will be (-5,+5) and an estimation period of 210 workind days prior to the respective event dates. Furthermore, a long term window of (-20,+20) will be employed in this study.

Steps:

i. Returns

$R_{iT} = Ln(P_t/P_t - 1)$

R_{iT} = Stock return of company i for period t

P_t = Stock price of company i for period t

P_{t-1} = Stock price of company i for period t – 1

ii. Beta

The beta coefficient reflects the sensitivity of a stock to market movements and is one of the parameters of time series regression. The researcher intends to estimate Beta using a standard market model, with the statistical model linking stock returns with the market index.

$R_{it} = \alpha + \beta R_{mt} + E_{it}$

R_{it} = Stock return of company i during the estimation period

α = Intercept from regression process result of daily stock return with daily stock return during the restimation period

β = Regression coefficient

R_{mt} = Return of NASI during the estimation period

E_{it} = Residual error that reflects other risks not available as beta or systematic risk

iii. Abnormal Returns (AR)

Where the market is not efficient, then the resulting return is an abnormal return, defined as the difference between the realized and expected return obtained by investors at the time of the occurrence, which may turn out to be a mere hope if an event does not actually transpire.

$AR_{it} = R_{it} - \beta(R_{mt})$

AR_{it} = Stock abnormal return for company i during period t

R_{it} = Stock return for company i during period t

β = Regression coefficient

R_{mt} = Return of IHSG during period t

iv. Average abnormal return

(AAR) = ∑AR / n NB

v. Cumulative Abnormal Return (CAR)

A CAR value is needed to describe the overall abnormal return during the event window.

$CAR_{it} = \Sigma\ (i=1\ldots n)AR_{it}$

CAR_{it} = Cumulative stock abnormal return during observation period (event window)

AR_{it} = Stock abnormal return for company i during period t

In this study, following windows are selected as shown below:

Table 2: Event Windows

	Event Windows	
Windows	**Calculation**	**Description**
Before event window	$CAR_{it} = \sum_{-3}^{-1} AR_{it}$	The window's main function is to detect information leaks or events that are anticipated before they occur.
	$CAR_{it} = \sum_{-3}^{+1} AR_{it}$	The window finds whether the event is expected or leaked; the market either absorbs it before to the event or continues to function abnormally following the occurrence.
Event window	$CAR_{it} = \sum_{0}^{+1} AR_{it}$	The window's purpose is to ascertain the market's initial reaction to the event, whether it absorbs on the spot or lasts very briefly, i.e. the day following the incident.
After window	$CAR_{it} = \sum_{0}^{+5} AR_{t}$	The event shows the long-term impact of the event, i.e., for the next five days after the event.
Full event window	$CAR_{it} = \sum_{-5}^{+5} AR_{t}$	The window is chosen in order to understand the full impact of the event day.

At t-test will then be used to establish significance of the abnormal returns paired sample t-test will be used to establish whether returns are significantly different before and after the

event implementation. The cumulative abnormal returns will also be plotted before and after the event implementation and CAR curve will also be observed for market reaction. (Anintyarini & Utama, 2018)

Simple regression models will be run after the event studies to boost evidence of market efficiency, where the dependent variable Y will be abnormal returns 5 days before and 5 days after the event implementation day, while the independent variable X will be each of the 4 events and will be categorical in nature where dummy variable 0 to represent 5 days before and dummy variable 1 to represent 5 days after the event implementation day. This will be the case for each of the 3 events.

$Y = a + bX + e$

3.7. Research Quality – validity, reliability and objectivity of the research

The research quality can be ascertained by cross checking the references cited and the data sources indicated. Some of the sources of information will include data and statistics from the NSE and KNBS. The study will employ tests for multicollinearity, normality and serial correlation.

Volatility tests will be carried out on pre and post event periods so to find out if the regulation contains information that causes the stock returns volatility depending on how the investors view the reform. The reform will be examined through one event with the period before the regulation being compared with post reform period where inferences will be made. For the test to be valid, both variables must be stationary. Stationary tests will be carried out on the data series. The study intends to employ Sharpe's market model (1992) to estimate the alpha and beta for the purposes of calculating abnormal returns. The study focuses on the means, standard deviation and variance of stock market returns.

3.8. Ethical Considerations

The researcher will obtain an ethical clearance letter in order to ensure compliance with ethical considerations in respect of this particular study. The researcher will also seek consideration and clearance from National Commission for Science, Technology and Innovation (NACOSTI). Data collected from the NSE will be analysed and presented in the appendix in a form that does not jeopardize the data restrictions of the NSE given that the market data is a key income earner for the NSE.

CHAPTER 4: RESEARCH FINDINGS

4.1 Introduction

The chapter will explain the findings based on the objectives of the study by applying empirical methods. It is divided into several subcategories. First, descriptive statistics are presented that are further elaborated by categorizing in several categories including companies, years, and events. Second, normality test was applied on full sample and separately on both events samples. Further, a serial correlation test is carried out to describe the relationship between observations of the same variable over specific periods. Next, Wilcoxon Signed – Rank test was applied to know the mean difference in CAR before and after the event. Additionally, the main findings of the selected events are given by highlighting findings on the different windows. Finally, regression analysis is performed to further strengthen the results of event methodology. Data was analysed using Stata 14.0 and SPSS 23 software.

4.2 Descriptive Statistics

4.2.1 Market Prices and Stock Returns by Companies: For the objective of conducting an analysis, the research gathered panel data from 69 different companies throughout the course of 19 years (June 2004 to April 2023). Data from 2004 to 2007 included market returns for the period – the researcher was unable to find data on prices during this period, however the market returns were useful in running the tests for the implementation of the CDS reforms which came to be on 10th November 2004. Lack of market prices during this period had little to no effect on the results of the study given that what the study is concerned with is the returns during the period under study. This data is presented in a cross-sectional format in Table attached in Appendix II. The prices of stocks and the returns on stocks fluctuate depending on the company. The companies have different number of observations ranging from 3718 (KCB) to 1 (LARP) on the basis of time when they came to market.

4.2.2 Market Prices and Stock Returns by Years: To better elucidate, data is presented over the years from 2004 to 1st quarter – 2023 as shown in table attached in Appendix 3.

To capture this information visually, the graph below shows the trends in NSE Market Returns. It is evident from Figure 1 below that stock returns remained low from 2004 till 2007, after which they peaked significantly till 2008. Notably, in 2008, the Safaricom Initial Public Offer (IPO) took place which was oversubscribed, attracting more than 800,000 new investors who invested more than Ksh.220 billion against the Ksh.50 billion that the company

was seeking through the offer. This was a significant contributor to the effect on market return trend noted in this season. This sets the scene for further research findings to be presented in the sections to come especially with regards to the influence of reforms implementation on the market returns through various event windows. These findings will help to paint a closer picture of what impact the respective reforms had on the market.

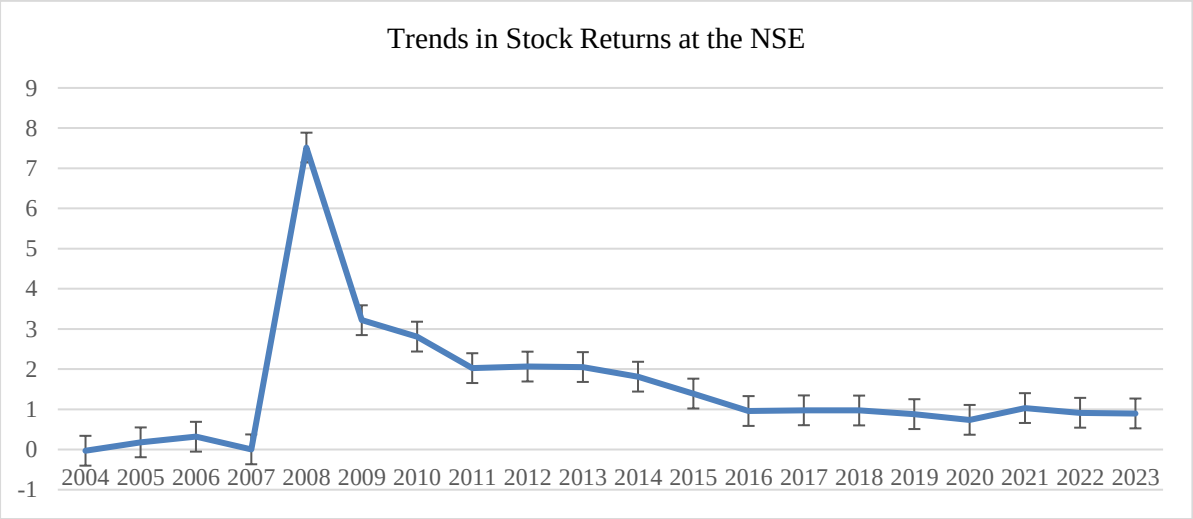


Figure 2: Stock Returns at the NSE: 2004-2023

4.2.3 Descriptive Statistics by Events

For highlighting data by events, tables 5,6 and 7 present, for each event, market price and stock returns 210 days prior to the date of two events and 210 days subsequent to the date of the event.

4.2.3.1 Descriptive Statistics by CDS: The descriptive statistics for CDS, presented in table 5, are further divided into three phases: before event happened, during and after the event and complete estimation period. Before event actually happened, the stock returns averaged 0.095% with 3496 observations. The average return mildly improved after the event actually incurred to 0.127%. The volatility also reduced after the event from 0.09 to 0.06. During the whole estimation period, the average return was 0.1125% with standard deviation 0.083%.

Table 3: Descriptive Statistics – CDS

	Descriptive Statistics – CDS		
Variable	**Obs.**	**Mean Returns (%)**	**Std. Dev. (%)**
Before Event			
Stock Returns	3496	0.09511	0.094455
During & After Event			
Stock Returns	4072	0.12774	0.06945

Complete Estimation Period			
Stock Returns	7568	0.11251	0.08359

4.2.3.2 Descriptive Statistics by Demutualization:

The results are broken down into three categories in Table 6: before the event, during and after the event, and across the whole estimation time. Observation of the standard deviation reveals that the post-event mean has a greater degree of volatility. Similarly, the event reveals negligible stock returns, some of which were even in the red after the event, that were showing some positive adjustment in the pre-event interval. The stock return stays rather modest over the entirety of the estimate period. In particular, it went from positive to negative over whole estimation period.

Table 4: Descriptive Statistics – Demutualization

	Descriptive Statistics – Demutualization		
Variable	**Obs.**	**Mean Returns (%)**	**Std. Dev. (%)**
Before Event			
Stock Returns	10200	0.06782	0.1008005
During & After Event			
Stock Returns	11671	-0.06585	0.0532697
Complete Estimation Period			
Stock Returns	21871	-0.00169	0.0796085

4.2.3.3 Descriptive Statistics by Automation: The findings presented in table below are further broken down into the three subheadings of "before," "during and after", as well as "across the whole estimation period." The stock market reflects with negative returns prior to the automation in September 2019. However, it is apparent from the findings that for the entirety of the event window, the prices on the market and the returns on stock investments were revitalized, mostly likely attributable to the major upgrade of the ATS.

Table 5: Descriptive Statistics – Automation

	Descriptive Statistics – Automation		
Variable	**Obs.**	**Mean Returns (%)**	**Std. Dev. (%)**
Before Event			
Stock Returns	10270	-0.09032	0.185847
During & After Event			
Stock Returns	9856	0.00942	0.0822574
Complete Estimation Period			

Stock Returns	20126	0.04911	0.1426285

4.3 Normality Test

Data is supposed to be normally distributed while applying most of the statistical tools. Therefore, it is always advisable to check whether data is normally distributed or not. Kolmogorov - Smirnov normality test is an eminent test that is preferred over the others recognized tests if the sample size is large. Thus, the study applied this method to check the normality of the data. H_0 (null hypothesis): data is normally distributed and H_1 (alternative hypothesis) data is not normally distributed.

To check normality, data is divided into four portions: full sample (2004 - 2023), CDS (-210 days – CDS day – +210 days) demutualization (-210 days – demutualization day – +210 days) and automation (-210 days – automation day – +210 days). From the results presented in table 4, the data shows strong indication of abnormality as p – value in each cash is less than 5%.

Given that it is expected that stock returns are not normally distributed, once the normality test indicated that the data is not normally distributed then log returns were used i.e Ln Returns = Ln (P1 / P0) and thereafter the abnormal returns were be computed from the log returns, where log returns attempt to normalize the data. Findings are presented in Table 8, which indicates that the stock index, stock returns and abnormal returns data for the 3 reforms are all normally distributed since p-values are greater than 0.05.

Table 6: Normality Test

	Normality Test		
	All Share Index[1]/ NSE 20 Index[2] (log)	**Stock Return (log)**	**Abnormal returns (log)**
Full Sample			
Test statistic	0.120[1]	0.151	0.1632
Sig.	0.127	0.119	0.117
CDS			
Test statistic	0.0971[2]	0.038	-0.175
Sig.	0.221	0.199	0.968
Demutualization			

Test statistic	0.0772[1]	0.064	0.057
Sig.	0.283	0.414	0.295
Automation			
Test statistic	0.0365[1]	0.014	0.054
Sig.	0.193	0.581	0.289

4.4 Wilcoxon Signed-Rank Test

This is a non-parametric variant of the t-test and operates in the same way. The Wilcoxon test will be most suitable in this case than others such as the Mann Whitney Test that assumes data is not normal. This is because the Wilcoxon test allows for greater variance. When attempting to assess whether or not there has been a change in score from one point in time to another, it is appropriate to apply the test.

The study applied the test to determine whether abnormal returns before and after the event window are significantly different. H_0 (null hypothesis): data both pre and post reform are the same and H_1 (alternative hypothesis) data both pre and post reform are not the same.

A p-value lower than 0.05 indicates that there is significant different across the two periods. The results in Table 11 indicate that there is a significant difference in abnormal returns before and after demutualization (0.0489) whereas for automation (0.0527) there was no significant difference and more so for CDS (0.8552) which indicates that there was no significant difference in abnormal returns in the pre and post period.

Table 7: Wilcoxon Signed-Rank Test

	Independent Sample t tests		
	CDS	**Demutualization**	**Automation**
Z	0.182	-1.997	-1.938
Prob > |z|	0.8552	0.0489	0.0527

4.5 Abnormal Returns and Cumulative Abnormal Return

4.5.1 Abnormal Returns

Abnormal returns (ARit) denote the difference between actual returns (ARit) and expected returns (ERit). To determine the abnormal return, ARit is regressed on All Share Index (Rmt). The sum of the abnormal returns over a time is called cumulative abnormal returns

(CAR). CAR is of utmost importance for event studies. If the CAR for the event window is significant, it denotes the impact of the selected event on abnormal returns. However, if CAR during the event window is insignificant, it indicates no effect of the event on the abnormal returns. The event window may be selected before the event and after the event ranging from short to long term.

The calculated values for the full event window including abnormal returns, average abnormal returns and standard deviation for each event is given in table 10. The results indicate normality of market reaction in case of CDS as the mean value nears zero (i.e. 0.082). However, in other two events, the market reacted abnormally and indicate the presence of inefficiency of the market. The mean values are -0.1319 and 0.5734 for demutualization and automation respectively. To further elaborate these findings, the graph also shows abnormal returns in (-5, +5) window for each of the event. It is evident from the graph that abnormal return during CDS does not follow any trend, whereas there is a pattern in case of demutualization and automation that indicates inefficiency of the market.

Table 8: Abnormal Returns (%)

	Abnormal Returns (%)		
Event Window	**CDS**	**Demutualization**	**Automation**
-5	-0.32326	-0.09673	0.747705
-4	0.208915	-0.1842	0.623987
-3	-0.73529	-0.16925	0.468968
-2	0.426674	-0.14486	0.782028
-1	0.257469	-0.10875	0.365357
Event Day	**0.174263**	**-0.18941**	**0.778223**
1	0.437065	-0.06893	0.822738
2	0.682995	-0.07686	0.450234
3	-0.2775	-0.30791	0.904431
4	-0.04989	-0.17367	0.170984
5	0.100818	0.069693	0.192958
Mean	0.082	-0.1319	0.5734
SD	0.405	0.094	0.2581

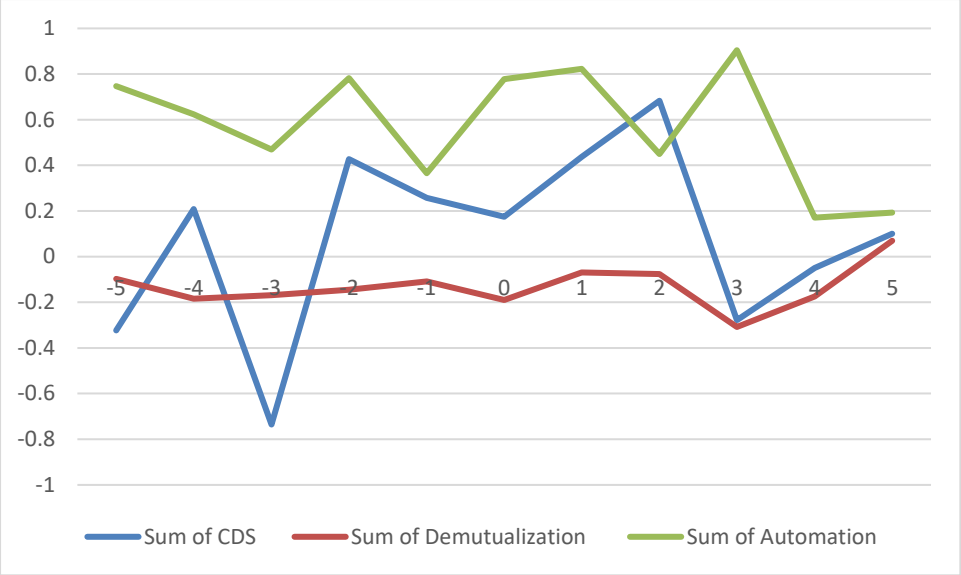


Figure 3: Demonstration of Abnormal Returns

4.5.2 Cumulative Abnormal Return

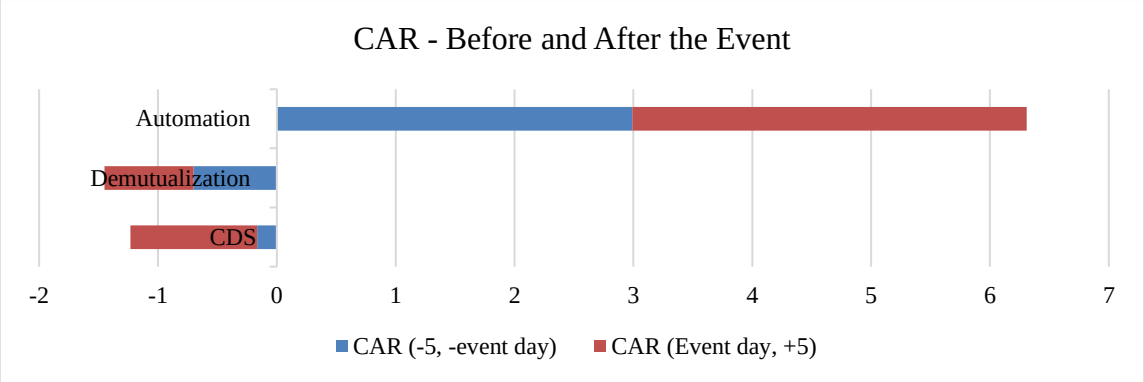
In order to determine whether CAR differs between pre-event window and post-event window, the event window is subdivided into pre-event window (-5, -1) and post-event window (0, +5). To analyze the significance of difference in CAR between pre and post event windows, t-test with the following formula is used:

$$t = \frac{CAR_{after} - CAR_{before}}{SE_{pre-post}}$$

In case of CDS, CAR in pre-event window was -0.165 and in post event window was -1.067 and the difference is significantly different with a t-stat of 8.6. It is further elaborated in figure that CAR reduced even before the event occurs, though the decrease became more prominent after the event happened. In case of demutualization, the difference between CAR in pre and post event windows is not significant. On the other hand, in case of automation, CAR differs significantly in pre and post event windows. A clearer representation of the difference in CAR in pre and post event windows is given in figure given below.

Table 9: Cumulative Abnormal Returns (CAR)

	Cumulative Abnormal Returns (CAR)		
	CDS	**Demutualization**	**Automation**
CAR (-5, -event day)	-0.165	-0.70	2.99
CAR (event day, +5)	-1.067	-0.75	3.32
Standard error for mean difference	0.1428	0.0345	0.09419
t-test	8.636	1.2536	-3.5197



4.6 Event Window Findings

For the purpose of the study, the event selected are CDS, demutualization and automation of trading system. Following table summarizes the findings that are explained thereafter:

Table 10: Cumulative Average Returns - Event Windows

		Cumulative Average Returns - Event Windows					
Event windows		(-3, -1)	(-3, +1)	(0, +1)	(0, +5)	(-5, +5)	(-20, +20)
CAR	CDS	-0.2301*	-0.2689	-0.4999	-0.8628	-0.4645	9.3279*
	Demutualization	-0.42285	-0.4285	-0.258	-0.747	-1.4508	-6.4584
	Automation	1.61635	3.21731	1.6009	3.3195	6.3076	20.7454

4.7.1 CDS

Before Event Window (-3, -1): This window covers a period of three observations, beginning three days before the event and ending one day before it takes place. The objective of the window is to ascertain whether or not the occurrence was expected and whether or not the influence of the occurrence started before the occurrence itself. It was determined that the CAR for this window is -0.23011, which is not statistically significant according to the t-test of -0.2135. This demonstrates that the revelation of the CDS may have created fears about growing costs, which ultimately resulted in a fall in CAR. However, the results are not significant.

Event Window (-3, +1): This window encompasses a total of five observations, beginning three days before the event and ending one day after it has already taken place. The window determines whether the market is able to absorb the information before to the event or if it

continues to function abnormally after the event has taken place. The CAR over the duration of this event window is statistically substantially negative at -0.2689 with a t-stat of -7.2485. It demonstrates that the market was unable to absorb the consequences of the event, and it also demonstrates that the market continued to function irregularly even after the occurrence. Even after the incident, the investors did not let go of their concerns about the possibility of rising prices and maintained lay low.

Event Window (0, +1): This window encompasses both the day of the event as well as the day preceding it. It determines the first reaction of the market to the occurrence and whether or not it is absorbed immediately or just lasts for a very short time. The CAR has a value of -0.4999, and t-value is -3.2142. It demonstrates that the market was unable to absorb the influence at the time of its occurrence, and the irregularity continued for some time after the incident.

After Event Window (0, +5): This window includes six observations, beginning with the day of the event and continuing through the five days that follow it. It establishes whether event has effects that continue to exist many even after a long time. The cumulative abnormal return (CAR) was calculated to be -0.8628 with a t-value of -5.826; this indicates that the incident had a substantial negative influence on the abnormal return that lasted over the long run. It demonstrates that the event considerably unsettled the investors because of the substantial increase in the cost of trading. It demonstrates that the investors continued to remain low at the stock exchange even after the event had been incurred.

Full Window (-5, +5): This window is used to evaluate the entire impact of the event both before and after it takes place. It was determined that the CAR was -.4645, and the significant t-value was -3.526. It demonstrates that the event has a large influence both before and after the effect, and it also demonstrates that the CAR is greatly lowered as a result of the event.

Long term Window (-20, +20): To incorporate the long-term impact and also to check the robustness of the other windows' results, -20, +20 window is also determined to check the abnormality of the returns. The CAR for long – window is 9.32 that is not significant. It validates the earlier findings of the insignificant of CDS in different event windows.

4.7.2 Demutualization

Before Event Window (-3, -1): This window consists of 3 observations, that is, from three days before the event to the one day immediately before the event. The purpose of the window is to determine whether the event was anticipated and whether its impact began even before its occurrence. The CAR in this window is found to be -0.42285 that is significant with t-test -8.0201. It shows the news of the demutualization may have raised doubts about the complexity of the procedure after demutualization that caused decrease in in CAR.

Event Window (-3, +1): This window consists of 5 observations, that is, from three days before the event to the one day immediately after the event. The window finds whether the market absorbs it before to the event or continues to function abnormally following the occurrence. The CAR during this event window is significantly negative, that is, -0.7470 with t-stat -6.93. It shows the market could not absorb the effect of the event and market continue functioning abnormally even after the event.

Event Window (0, +1): This window consists of the day of the event and one day before the event. It ascertains the market's initial reaction to the event, whether it absorbs on the spot or lasts very briefly. The CAR is significantly negative, that is, -0.2583 with t-value -2.1442. It shows market could not absorb the effect on the spot but the abnormality last shortly after the event.

After Event Window (0, +5): This window consists of 6 observations from the day of event to the five following days. It determines whether event has effect that last long after its occurrence. The CAR is found to be -0.7470 with t-value -6.937 that shows event has significant negative effect on the abnormal return that last over the long term.

Full Window (-5, +5): This window determines the full effect of the event before and after the event. The CAR is found to be -1.4508 with significant t-value of -4.617. It shows event has significant effect before and after the effect and CAR is reduced significantly due to the event.

Long – term Window (-20, +20): Validating the other windows' results, this window also shows significant negative impact of the event with CAR -6.4584. It strengthens earlier findings that demutualization may have raised doubts about the complexity of the procedure

that hovered over the long – term and continued decline in abnormal return after several days of the event.

4.7.3 Automation

Before Event Window (-3, -1): This window consists of three observations, or the three days prior to the event date and the day before it. The goal of the window is to establish whether or not the event was foreseen and whether or not its influence started even before it occurred. The CAR in this window is found to be 1.6163 that is significant with t-test 4.3018. It shows positive impact of the automation with perceived positive sentiments among the investors about impact of automation on trading.

Event Window (-3, +1): Five observations make up this window, which spans the period from three days before the occurrence to the day after it has occurred. The window determines whether the market absorbs it before to the event or keeps operating abnormally after it. The CAR in this window is 3.2173 with t-stat 6.834. it indicates positive influence of the event even before it actually happened through a day after it has been incurred. It shows positive short-term effect of the event on abnormal returns.

Event Window (0, +1): The day of the event and the day before it makes up this window. It determines the market's early response to the occurrence, including whether it immediately absorbs or just lasts a short while. The CAR is significantly negative, that is, 1.6009 with t-value 35.9645. It demonstrates how the market was unable to immediately absorb the influence, but the irregularity persisted shortly after the incident.

After Event Window (0, +5): Six observations are included in this window, which spans the event's day and the five days after it. It establishes that the incident has effects that persist for a long time. The CAR is determined to be 3.3195 significant with t-stat 4.1503. It shows event has long term effect after its occurrence. In addition to the short – term effect, the effect of the event remains over a long – term after its occurrence.

Full Window (-5, +5): This window determines the full effect of the event before and after the event. The CAR is found to be 6.3076 with significant t-stat 7.3682. It shows event has significant effect before and after the effect and CAR is increased in anticipation as well as after the event.

Long – term Window (-20, +20): The result of the window also shows significant positive impact of the event. The CAR is 20.7454 that is significant. It validates the results of the other windows that also showed positive and significant impact of the event.

4.7 Regression Analysis

After applying event methodology to find results, it is recommendable to strengthen the results by applying regression analysis of the same data. Therefore, three regressions are run to determine the impact of the events on the abnormal returns.

The output is as follows:

4.8.1 Demutualization: The regression results given in table below validates the findings of earlier event study method. The regression coefficient of the demutualization to abnormal returns is found to be negative. However, the coefficient is found to be insignificant.

4.8.2 Automation: On the other side, the effect of automating the trading system on stock returns is found to be insignificantly positive. It is also to validate the earlier findings with the event methodology that found positive CAR in automation event windows.

4.8.3 CDS: Regression on CDS shows the impact of CDS on abnormal returns. The results also validate the presence of negative impact of CDS on the stock returns, though the regression coefficients are not significant.

Table 11: Regression Analysis

	Regression Analysis			
Independent variables	**Coef.**	**Std. Err.**	**t**	**P>t**
Regression 1				
CDS	.2110	.2487	.8483	.4182
Constant	-0.0331	.1837	-.1801	.8610
F stat	.719			
Prob > F	.4182			
Regression 2				
Demutualization	-.09915	.59054	-0.17	0.867
Constant	-.48852	.42538	-1.15	0.251
F stat	0.03			
Prob > F	0.8667			
Regression 3				
Automation	.038367	.0214384	1.79	0.074
Constant	.0307195	.0153009	2.01	0.045

F stat	3.20			
Prob > F	0.0742			

Upon regression analysis, automation reform event has a significant and positive effect on stock abnormal returns (coefficient = 0.038 and p-value = 0.074 < 0.1) at 10% confidence level.

4.8 Serial Correlation

To ascertain if the error term in the linear regression model follows an AR (1) process, that is autoregressive process is one in which the current value is based on the immediately preceding value, Durbin Watson test is applied. The test's null hypothesis is that first-order autocorrelation does not exist. Under the null, the Durbin-Watson d statistic has a value of 2, and its range of possible values is 0 to 4. As per this, test 0 - 0.98 = positive autocorrelation; 0.98 - 1.24 = test is inconclusive; 1.24 - 2.76 = no autocorrelation; 2.76 - 3.02 = test is inconclusive and 3.02 - 4 = negative autocorrelation.

For CDS (2.35) and demutualization (1.85) results in table below indicate there is no autocorrelation pattern which is consistent with efficient markets. For automation (3.09) there is negative autocorrelation pattern which is not consistent with efficient markets and thus in the period of automation of the NSE, the market experienced inefficiency.

Table 12: Serial Correlation

	Serial Correlation
Event	**d-stat**
CDS	2.35
Demutualization	1.85
Automation	3.09

4.9 Heteroscedasticity test (Breusch Pagan test)

Heteroscedasticity is a problem that arises when error term is not constant across the sample. In order to determine whether or not heteroscedasticity is present in a regression model, Breusch – Pagan test is performed. The test uses the following null and alternative hypotheses. Null Hypothesis (H_0): Homoscedasticity is present (the residuals are distributed with equal variance); Alternative Hypothesis (H_A): Heteroscedasticity is present (the residuals are not distributed with equal variance). The null hypothesis is rejected for p-value less than 0.05. Thus, the error terms are not distributed with equal variance for all events.

Table 13: Heteroscedasticity (Breusch Pagan test)

Events	**Chi^2**	**P-value**
CDS	0.06	0.8041
Demutualization	0.10	0.7881
Automation	0.11	0.7442

CHAPTER 5: CONCLUSION AND DISCUSSION OF FINDINGS

5.1 Introduction

This chapter discusses the research findings, conclusions and recommendations for the study. Section 5.2 discusses the findings in relation to objectives of the study. Section 5.3 gives the conclusion for the study. Section 5.4 suggests areas for further research. Section 5.5 provides limitations for this research.

5.2 Discussion of Findings

5.2.1 Effect of Automation

Over the last 13 years, the NSE has made use of an Automated Trading System (ATS) to make trading in securities easier. On September 26, 2019, ATS underwent a major upgrade to improve its operational efficiency and technological capabilities with the aim of improving service delivery in the market. It was anticipated that the updated system will be able to accommodate an improved product offering, reduce the number of incidents of system unavailability and malfunction, increase liquidity by permitting day trading, and make it easier to lend and borrow securities. Following the implementation of the ATS upgrade, the market demonstrated substantial growth during the final quarter of the year 2019.

The results of the study are also aligned with these facts. As automation is not an overnight process, it was well known by the investors before its implementation, thus the market started to react positively even before the event. Therefore, two before event windows including (-3, -1) and (-3, +1) had positive and significant CARs that shows that the upgrade of ATS has positive impact on the investors' sentiments that stirred up the stock returns. The positive reaction of the event remains persistent on the day of implementation of upgraded ATS.

Stock markets might go volatile, or investors might fear data manipulation after automation of the system, though that was not the case in the case of NSE. Therefore, window (0, +1) also showed positive CAR. Moreover, to capture the stock returns' reaction to the event after it has been incurred, post event window (0, +5) is used that also shows positive CAR that indicates the positive reaction of the market persisted several days after the event. Finally, the overall effect of the event is determined with full window (-5, +5) that also shows strong positive CAR. Likewise, the long-term Window (-20, +20) showed significant positive impact of the event, where the CAR was 20.7454 that is significant. It validates the results of the other windows that also showed positive and significant impact of the event.

The results further solidify findings in literature such as (Mwangi M. , 2015) and (Okumu, 2013) that also reported increase in market returns following the initial automation of the trading system. An additional example of the influence that automation has had on stock returns can be observed in the United States, where the introduction of computerized trading platforms in the 1990s led to a significant increase in trading volumes and better market efficiency. This is just one example of how automation has affected stock returns. As a consequence of this, investors were able to buy and sell stocks with greater ease and for lower prices, which, in turn, led to improved returns on stock investments. Finally, the results are also validated with regression analysis that also found positive impact of the automation on abnormal returns.

5.2.2 Effect of CDS

The NSE launched the Central Depository System (CDS) in 2004 with the intention of simplifying the trading and settlement procedure in order to boost the functioning capacity of the stock market. However, following the introduction of the CDS, the market saw a large drop in trading volumes and liquidity, which ultimately resulted in a reduction in the returns on stocks traded on the market. One possible explanation for the market's lack of liquidity is investors' pessimism over the CDS and the hefty fees that are linked with it.

The same is found by determining the impact of the event on several alternative windows. Among various windows, the CAR is found to be negative on account of the event. Although the negative reaction before the event was not significant as shown by window (-3, -1), it became significant in window that included the post event date i.e. (-3, +1). It shows that the negative reaction was not superficial but became stronger after the event. Moreover, the windows (0, +1), (0, +5) also showed negative and significant CAR that indicates that the event had long term detrimental effect on the stock exchange. Finally, a full window (-5, +5) also shows negative effect of the CDS on the stock returns. The CAR for long term window (-20,+20) is not significant. It validates the earlier findings of the insignificance of CDS in different event windows.

Past studies have revealed that stock markets in India, Bangladesh, Mauritius and Kenya have experienced growth across several stock market indicators following the implementation of CDS. This study thus shows a conflicting finding specifically on the relationship between market returns and the CDS implementation, as explained above.

5.2.3 Effect of Demutualization

It was anticipated that demutualization would result in improvements to the governing structure of the exchange, more transparency, and increased interest from new investors. The demutualization of the NSE has contradictory effects on the performance of individual stocks. Following the completion of the conversion, the exchange went through a period of volatility and uncertainty, which resulted in a reduction in the overall volume of trading and a fall in the total market capitalization. Some investors were concerned, as well, about the potential for conflicts of interest to arise as a consequence of the new ownership structure of the exchange.

The same is empirically evidenced by the study. Among several alternative windows, including before event and after the event, the CAR is found to be negatively influenced by the event. The negative impact began even before the actual occurrence of the event as shown by windows (-3, -1) and (-3, +1), both have negative CAR. The negative reaction of the investors was not merely restrained before demutualization but hovered at the time of the event. As the window (0, +1) also indicates negative CAR. Moreover, to capture the stock returns' reaction to the event after its occurrence was also determined with post event window (0, +5) that also shows negative CAR that indicates the negative reaction of the market persisted several days after the event. To pierce through the overall effect of the event, a full window (-5, +5) was also assessed that also showed strong negative impact of the event on stock returns. Long term window (-20, +20) validates the other windows' results, this window also shows significant negative impact of the event with CAR -6.4584. It strengthens earlier findings.

The findings are backed up by a number of research, including Serifsoy (2008) and Morsy & Rwegasira (2010) which concluded that there was no evidence of a favorable impact of demutualization on stock exchanges on stock returns. These findings provide support for the conclusions. There are several instances from the past that serve to validate the findings, such as the well-known demutualization of the Australian Stock Exchange (ASX) in the year 1998. Before it became a publicly traded company, the Australian Securities Exchange (ASX) was owned by its members, the majority of which were large banks and other financial institutions. In order to complete the demutualization procedure, a new company called ASX Limited was established.

Although it was anticipated that the demutualization of the ASX would result in significant benefits, such as increased liquidity and improved access to capital, the initial effect of the demutualization was detrimental to the returns on the stock market. Concerns about greater competition and regulatory uncertainty led to a decrease in the value of ASX shares to around 20% in the months that followed the demutualization of the exchange. At the end, the results of the mutualization are also validated with the application of regression analysis. The regression coefficient was negative that corresponds to the event study results, though the coefficient was not significant.

5.3 Conclusion

Based on the research objectives, stakeholders can draw meaningful inference from the research findings and the conclusion is given in this section. Market reforms, specifically, automation, CDS implementation and demutualization correlate with market efficiency. Key methods employed to assess market efficiency in this study are examination of the abnormal returns, where abnormal returns should sum up to zero in stock markets that are efficient, while the results of this study show consistent significance of abnormal returns from zero, which is an indicator of market inefficiency. Normality of market reaction is noted in case of CDS as the mean value nears zero; however, in the case of automation and demutualization, the market reacted abnormally and indicate the presence of inefficiency of the market. Additionally, volatility should be moderate not be excess volatility or less than moderate volatility in efficient markets and results reveal volatility across all three reforms upon implementation. Furthermore, serial correlation is an indicator of efficient capital markets, where zero serial correlation is an assessor of efficient markets. The findings of this study reveal that in the case of CDS and demutualization reforms implementation, there is no autocorrelation pattern which is consistent with efficient markets. However, in the case of automation reforms, there was negative autocorrelation pattern which is not consistent with efficient markets and thus in the period of automation of the NSE, the market experienced inefficiency. The findings thus show that the local stock market is largely inefficient around the time of implementation of major reforms, namely, automation, demutualization and implementation of CDS reforms. This could be an indicator that the stock market needs to widen and ensure better accessibility to information around key reforms prior to their implementation for them to be well received by the markets and thus to achieve the full intention of the proposed reforms.

5.4 Recommendations

Policy makers and stock market practitioners including the market regulator can use the results from this study to determine best practise to be taken while implementing market reforms. Based on the study, automation reforms have been found to have positive effects on market returns and thus upcoming and developing markets could prioritize such reforms in their growth strategies and policy planning. While demutualization and CDS reforms are also seen to have an effect, they could be prioritized at the right stage of market development and also putting into consideration factors such as cost implications for market players and market sensitization, before being introduced to the market to maximise on the positive impact on returns once these reforms are implemented. Upcoming stock markets with similar growth profiles to the local Kenyan context could use this as a barometer while deciding which market reforms to prioritize. Further, there is much room to improve on market efficiency in the local stock market especially around the time of implementing key market reforms. Additionally, policy makers are advised to do proper and localised market research to ensure that the reforms being introduced will be timely and create greater positive impacts for the market. Stock market practitioners could find this information useful while making decisions on the type of reforms to focus on; notably, reforms relating to automation could be more of the focus for market players as these have been seen to have most positive effects.

5.5 Areas for Further Research

Following the literature review and the findings of this study, further research could be conducted on reforms that have happened in the markets in the more recent past. Additionally, there is an opportunity to conduct comparative studies with more developed stock markets such as those in Asia and America, to present comparative findings across different jurisdictions. This could lead to shared value being derived across the different markets. Further research could also be conducted using the difference in difference method.

5.6 Limitations of the Study

The study was conducted on 3 key reforms implemented in the NSE, that is CDS implementation, automation, and demutualization. Though these reforms could have also been implemented in other markets, results from this study are specific to the Kenyan stock market and cannot be generalized across other markets.

Availability of data in the early 2000s was limited; this forced the researcher to remove a key reform from that could have been studied which is the insider trading law reforms. These were introduced in the year 2000, for which data was unavailable to run the necessary tests.

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APPENDICES

Appendix I: Literature Review Summary and Gaps

Author	Title of Study	Findings	Research Gap	How this study will fill the gap
Automation and reforms				
Torre, Gozzi and Schmukler (2007)	Stock Market Development under Globalization: Whither the Gains from Reforms?	Findings in Kenya were inconclusive for Kenya for 4 reform indicators: enforcement of insider trading laws, introduction of electronic trading systems, institutional reform and pension reform.	Effects of enforcement of insider trading laws, introduction of electronic trading system following automation reforms implementation yet to be researched	This study intends to analyse the impact of insider trading reforms, electronic trading systems and institutional reform in the Kenyan context.
Mensah, Pomaa-Berko and Adom (2012)	Does Automation Improve Stock Market Efficiency? Evidence from Ghana.	Automation did not improve efficiency at the GSE	There is an opportunity for study to be done in Kenya	The study aims to replicate the study in Kenyan context in addition to the other reforms.
Omuchesi, Bosire and Muiru (2014)	The Effect of Automation on Stock Market Efficiency: A Case of Nairobi Securities Exchange.	No difference between in returns that could be attributed to the operation of the automated trading system.	Study was done in 2014 – the most recent upgrade to the ATS was done in 2019. There is room to investigate the returns in relation to this most recent upgrade	This study will look into the most recent upgrade to the ATS - October 2019: The NSE launched a new trading system provided for by Millennium Technologies who are part of London Stock Exchange Group
(Nyangara & Musikavanhu, 2014)	An Empirical Analysis of the Impact of Demutualization on Stock	Automated exchanges exhibit less trading activity than non-automated exchanges after controlling for other factors.	There is room to conduct a similar study in the Kenyan context.	This study will look into stock market efficiency as a result of demutualization of the Nairobi

	Exchange Performance: Lessons for Zimbabwe.			Stock Exchange.
Mwangi (2019)	Effects of Automated Trading System (ATS) on the Efficiency of Nairobi Securities Exchange, Kenya for the Period 2013 to 2017.	The study revealed that efficiency improved significantly and there was increase in regularity of trades, easy access to funds and increase in the trading volumes.	Study was done for the period between 2013 – 2017; most recent upgrade to the ATS was done in 2019. There is room to investigate the returns in relation to this most recent upgrade	This study will look into the most recent upgrade to the ATS - September 2019: The NSE launched a new trading system provided for by Millennium Technologies who are part of London Stock Exchange Group
Central depository system				
Chowdhury & Huda (2017), Garg (2016) Kumar (2020) Nowbutsing & Odit (2009) Otuko (2006)	Analyzing the growth and development of Central Depository in respective countries	Although insignificant, there was growth in the indicators measured during the period following implementation of the CDS. The indicators included market capitalization, market turnover, turnover ratio, shares traded and the number of transactions.	Most of these studies focus on more developed Asian markets. There is room to conduct a similar study locally and examine the impacts on market returns.	The study aims to look specifically into the impact of CDS implementation in the Kenyan context and how the market reacted.
Stock Market Reaction and Demutualization Reforms Implementation				
(Serifsoy, 2008)	Demutualization, outsider ownership, and stock exchange performance: empirical evidence.	There was no evidence that publicly listed exchanges possess higher efficiency and productivity values than demutualized exchanges with a customer-dominated structure	The NSE was excluded from this study.	This study aims to examine demutualization effects on market efficiency in the Kenyan context.
(Morsy & Rwegasira, 2010)	Demutualization, outsider ownership, and stock exchange performance:	Demutualization programmes do not improve market performance of the equity and bond markets for all 16 indicators tested	Study did not highlight Kenya in its investigation and findings	This study aims to examine demutualization effects on market efficiency in the Kenyan context.

	empirical evidence.	in the study.		
(Azzam, 2010)	Stock Exchange Demutualization and Performance.	Demutualization increases an exchange's financial performance, size, and liquidity thus it is a value enhancing process for both the exchange and its shareholders	NSE demutualized in 2014 hence was excluded from this study.	This study aims to examine demutualization effects on market efficiency in the Kenyan context.
(Mwangi, 2018)	The Impact of Demutualization on Financial Performance of a Stock Exchange: As Case Study of Nairobi Securities Exchange.	Significant effects found.	Non-financial metrics, specifically market efficiency yet to be investigated	This study aims to build on the relationship between NSE demutualization and market efficiency.
(Altaf, 2009)	Demutualization of Stock Exchanges. A case study: London Stock Exchange and Hong Kong Stock Exchange	Demutualized stock exchanges hold a stronger operating performance and a better performance in term of shareholder's return than mutual exchanges	Study did not highlight Kenya in its investigation and findings	This study aims to examine demutualization effects on market returns in the Kenyan context.
(Sial, Tahir, Zulfiqar, Iqbal, & Naqvi, 2014).	Demutualization of Stock Exchanges and Stock Market Growth: Broader Economic Investigation of Demutualized Exchanges.	Stock exchanges are performing better in all levels of economies after the demutualization in many dimensions except in number of transactions in low level economies.	Study did not highlight Kenya in its investigation and findings	This study aims to examine demutualization effects on market returns in the Kenyan context.
(Alam, Sial, Talib, & Ashkanani, 2015).	Demutualization of Stock Exchanges: A Corporate Blessing in Disguise for Stock Market Growth.	Stock market growth noted in terms of number of listed companies, number of transactions in equity market, stock index, and market capitalization.	Study did not highlight Kenya in its investigation and findings	This study aims to examine demutualization effects on market returns in the Kenyan context.

VT OMNES
VNVM SINT

Appendix II: NSE Listed Companies

AGRICULTURAL
Eaagads Ltd Ord 1.25 ***AIMS***
Kakuzi Plc Ord.5.00
Kapchorua Tea Kenya Plc Ord Ord 5.00***AIMS***
The Limuru Tea Co. Plc Ord 20.00***AIMS***
Sasini Plc Ord 1.00
Williamson Tea Kenya Plc Ord 5.00***AIMS***
AUTOMOBILES & ACCESSORIES
Car & General (K) Ltd Ord 5.00
BANKING
ABSA Bank Kenya Plc Ord 0.50
BK Group Plc Ord 0.80
Diamond Trust Bank Kenya Ltd Ord 4.00
Equity Group Holdings Plc Ord 0.50
HF Group Plc Ord 5.00
I&M Group Plc Ord 1.00
KCB Group Plc Ord 1.00
NCBA Group Plc Ord 5.00
Stanbic Holdings Plc ord.5.00
Standard Chartered Bank Kenya Ltd Ord 5.00
The Co-operative Bank of Kenya Ltd Ord 1.00
COMMERCIAL AND SERVICES
Deacons (East Africa) Plc Ord 2.50***AIMS***
Eveready East Africa Ltd Ord.1.00
Express Kenya Plc Ord 5.00***AIMS***
Homeboyz Entertainment Plc 0.50***GEMS***
Kenya Airways Ltd Ord 1.00
Longhorn Publishers Plc Ord 1.00***AIMS***
Nairobi Business Ventures Plc Ord. 0.50***GEMS***
Nation Media Group Plc Ord. 2.50
Sameer Africa Plc Ord 5.00
Standard Group Plc Ord 5.00
TPS Eastern Africa Ltd Ord 1.00
Uchumi Supermarket Plc Ord 5.00
WPP Scangroup Plc Ord 1.00

CONSTRUCTION & ALLIED
ARM Cement Plc Ord 1.00
Bamburi Cement Plc Ord 5.00
Crown Paints Kenya Plc Ord 5.00
E.A.Cables Ltd Ord 0.50
E.A.Portland Cement Co. Ltd Ord 5.00
ENERGY & PETROLEUM
KenGen Co. Plc Ord. 2.50
Kenya Power & Lighting Co Plc Ord 2.50
Kenya Power & Lighting Plc 4% Pref 20.00
Kenya Power & Lighting Plc 7% Pref 20.00
TotalEnergies Marketing Kenya Plc Ord 5.00
Umeme Ltd Ord 0.50
INSURANCE
Britam Holdings Plc Ord 0.10
CIC Insurance Group Ltd Ord.1.00
Jubilee Holdings Ltd Ord 5.00
Kenya Re Insurance Corporation Ltd Ord 2.50
Liberty Kenya Holdings Ltd Ord. 1.00
Sanlam Kenya Plc Ord 5.00
INVESTMENT
Centum Investment Co Plc Ord 0.50
Home Afrika Ltd Ord 1.00***GEMS***
Kurwitu Ventures Ltd Ord 100.00***GEMS***
Olympia Capital Holdings Ltd Ord 5.00
Trans-Century Plc Ord 0.50***AIMS***
INVESTMENT SERVICES
Nairobi Securities Exchange Plc Ord 4.00
MANUFACTURING & ALLIED
B.O.C Kenya Plc Ord 5.00
British American Tobacco Kenya Plc Ord 10.00
Carbacid Investments Plc Ord 1.00
East African Breweries Plc Ord 2.00
Flame Tree Group Holdings Ltd Ord 0.825***GEMS***
Kenya Orchards Ltd Ord 5.00***AIMS***
Mumias Sugar Co. Ltd Ord 2.00

Unga Group Ltd Ord 5.00
TELECOMMUNICATION
Safaricom Plc Ord 0.05
REAL ESTATE INVESTMENT TRUST
ILAM FAHARI I-REIT Ord.20.00
LAPTRUST IMARA I-REIT Ord.20.00
EXCHANGE TRADED FUNDS
ABSA New Gold ETF

Appendix III: Descriptive Statistics by Companies

	Descriptive Statistics by Companies						
Companies	**Market Price**	**Stock Return**	**N**	**Companies**	**Market Price**	**Stock Return**	**N**
ABSA	21.4572	1.316649	3637	KPLC	34.9950	9.356923	3716
ACCS	14.3370	1.682422	1240	KQ	16.7550	2.249737	3020
ADSS	4.9917	2.788545	430	KUKZ	192.0732	1.560889	1884
ARM	89.4690	2.411994	2505	KURV	1500.0000	1.479839	9
BAMB	136.6763	1.345488	3338	LAPR	20.0000	.0133333	1
BAT	484.6358	1.13055	3329	LBTY	12.0919	1.111092	2821
BKG	25.2861	1.10536	462	LIMT	501.6145	1.31098	502
BOC	104.0419	1.086704	1742	LKL	6.9870	1.274232	2466
BRIT	10.9844	1.170975	2893	MSC	4.2223	1.081184	2840
CABL	10.4871	2.890419	3696	NBK	22.9166	2.695911	2812
CARB	43.9206	2.130628	2998	NBV	3.5033	1.749818	1381
CGEN	33.9933	1.122444	1772	NCBA	38.1039	2.206329	3713
CIC	4.5310	1.177052	2677	NMG	133.8634	1.078042	3712
CMC	13.0236	1.055591	832	NSE	14.1556	1.713057	2139
COOP	14.6148	1.049914	3577	OCH	4.5044	1.169708	3182
CRWN	52.6845	1.183296	2776	ORCH	69.0204	1.258433	179
CTUM	27.2332	1.161657	3717	PORT	49.4125	2.732955	2072
DCON	3.7140	2.420813	436	REA	17.1099	2.243052	1234
DTK	127.1627	1.107656	3606	SASN	16.0286	1.056287	3555
EABL	214.0265	1.033116	3714	SBIC	81.1368	1.087822	3437
EGAD	26.1271	1.258334	1783	SCAN	28.8609	1.138449	3689
EQTY	44.9180	1.285267	3718	SCBK	207.2054	1.603078	3713
EVRD	2.2698	1.294276	3695	SCOM	17.1915	1.056963	3712

FAHR	9.6911	1.170318	1782	SGL	30.3790	1.236673	2822
FTGH	3.6652	1.684169	1957	SLAM	45.9062	1.184185	2796
GLD	1267.2222	200.055	18	SMER	4.4348	1.530574	3554
HAFR	1.8060	3.053733	2425	TCL	11.4041	1.111647	2542
HFCK	15.9581	1.424447	3712	TOTL	24.1028	3.75444	3581
IMH	76.5458	1.602206	2120	TPSE	35.2123	1.051193	3322
JUB	305.0331	1.097832	3327	UCHM	6.2371	1.203359	2943
KAPC	104.6577	1.070124	1653	UMME	10.5000	7.140936	1505
KCB	36.1803	1.093918	3718	UNGA	23.9479	1.191689	3022
KEGN	9.3498	1.31824	3718	WTK	180.6782	1.154263	2550
KENO	21.1646	1.378284	2598	XPRS	5.9805	1.119245	2568
KNRE	11.8749	1.447747	3717				

Appendix IV: Descriptive Statistics by Years

	Descriptive Statistics by years			
Years	**Stock Returns**		**Market Price**	
	Mean	**Std. Err.**	**Mean**	**Std. Err.**
2004	-.030482	.7872687	73.8969	74.31902
2005	.178712	.6416181	72.5145	76.09454
2006	.318388	1.222022	71.1322	77.87006
2007	.004104	1.300802	69.7498	79.64557
2008	7.515407	.2343238	65.4369	66.87395
2009	3.218543	.0958441	45.6453	47.62464
2010	2.810167	.0791268	66.3900	69.77052
2011	2.025471	.0519399	57.0759	69.54262
2012	2.064415	.0690327	54.3814	80.38417
2013	2.05292	.0532277	70.0046	107.27168
2014	1.813037	.0290342	84.5261	137.63546
2015	1.392382	.0134677	78.9505	144.62814
2016	.9585084	.0099881	63.9483	134.57093
2017	.9755984	.0111728	60.0550	129.74328
2018	.9711874	.0070474	58.6643	115.18713
2019	.880505	.082927	53.2618	104.69966
2020	.7387739	.0032881	42.5851	79.91514
2021	1.031445	.0101136	42.9942	86.34042
2022	.9145047	.0035397	42.7590	86.19756
2023	.8977742	.0064592	41.3202	83.82266