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The Effect of Automation on Trading Volumes of Listed Companies at the Nairobi Securities Exchange, Kenya

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Abstract
Evidence from around the world indicates massive percentage of stock exchanges adapting electronic trading platforms and a prediction that this adapting trends will continue. Institutional investors prefer speed brought by technology as opposed to price preferred by retail traders who prefer market makers and floor trading. Technology leads to reduction in cost, transparency, market volatility and liquidity, internationalization of trading and settlement systems. There has been a reverse reaction particularly due to the fact that most of the trading has a lot of anonymity and elimination of market players which have a key role in price formation. This paper examines the effect of automation on trading volume of companies based on a study of companies listed on the Nairobi Securities Exchange. The study was a quantitative case study. A total of 41 companies were examined for periods between year 2003 and 2009. Electronic trading was introduced in 2006; therefore, in order to ascertain the cause-effect relationship, the study took three years behind and three years ahead in order to eliminate any season-ability effects. The results showed that automation increased volume of companies' equities traded during these periods. However, few companies showed that there was no effect on the companies' equity volumes traded, which may have been caused by other factors, including either organizational, macro or micro economic and therefore unrelated to the system introduced. It was thus recommended that in the process of demutualization, the NSE should consider allowance for further study on the goings-on at the NSE by allowing students and scholars to obtain data free of charge or at a significantly nominal fee. The study is important as it appreciates and underscores the effect of continued change in technology is having on the mobilization of resources in stock and securities exchanges in Kenya and around the world.
Keywords: Electronic Trading, Nairobi Securities Exchange

1. INTRODUCTION

Since its inception, there have been slow but steady reforms to make the Nairobi Securities Exchange (NSE) an attractive market for companies to list. It has been observed that reforms are a prerequisite for stock market development and increased participation of institutional investors in the financial markets. The evolution process that has occurred, both in the emerging and developed world, in the institutional infrastructure and policy environment is seen as efforts to facilitate the growth of the market.

This evolution process indicates the gradual development from informal markets to formalization, initially without regulatory bodies and other formal market players, to establishment of regulatory bodies and recognized market players in the process. To underpin the importance of reforms in the stock market in Kenya and the extent of the evolution process, in December 16th, 2010, in a press communiqué following a joint meeting of the Capital Market Authority (CMA), the NSE, and the Central Depository and Settlement Corporation (CDSC) indicated a number of steps towards achieving this goal. These included, among other things, the modernisation of market infrastructure and practice which included initiatives towards improvement of automated trading systems which had been put in place since September 2006, and also strengthening the Central Depository System. Other improvements discussed in the meeting were to have a standardized Broker Back Office System, strengthening market intermediaries by introduction of risk based supervision and emphasizing on good corporate governance and conduct of business with international best practice business codes and fast tracking the integration of East African Securities Regulatory Authorities Association.

The application of automated trading systems has changed the landscape of business in stock exchanges around the world. As a departure from the past, the boisterous movement of brokers in the trading floor has given way to quite screen-based trading. Electronic trading is noted to have many benefits, including the fact that institutional investors appreciate speed as opposed to price *per se*. Moreover, the fact that there is increased transparency has

changed the liquidity and increased integration of markets giving way to participation of foreign investors. It has also provided a means for better market surveillance both by the regulatory authorities and other stakeholders in the market.

Despite these benefits, it is unclear whether or not electronic trading has affected the trading volumes of companies trading at the NSE. Therefore, the purpose of the study was to investigate whether the trading volumes of companies have been affected before and after the implementation of the automatic trading systems.

1.1 LITERATURE REVIEW

Automation involves the implementation of a computerized and electronic system for trading and settlement purposes (Adjasia & Yartey, 2007). According to Huang and Stoll (1992), this is supposed to meet the ever-increasing competitive pressures in modernized markets. Technology has long played a key role in changing the securities trading. Communications technology in particular has had a major impact on trading practices. Since the manual system of clearing and settlement lengthens the financial transaction period, automation has significantly reduced the process (Ngugi, 2003). Haung and Stoll (1992) aver that automation increases market transparency and anonymity enabling the expansion of foreign securities market. Milling and Zimmermann (2010) add that since institutions often trade professionally, securities even with a short-time horizon, the trading speed is of even much greater importance to them than the price.

From the open outcry system to on-line screen based system, technology has been of unprecedented importance in changing the market practices. Computer technology as the prerequisite to electronic trading has developed thus technically eliminating people in the order marching process (Milling & Zimmermann, 2010). For example, before the introduction of on-line screen based electronic trading, in 1878, phone lines from brokers to the New York stock exchange floor was installed. Garbade and Silber (1978) show that a New York Philadelphia telegraph in New York and a New York-London connection, in 1866, quickly cut price differentials between the cities markets in equities, bonds and stock (Clemons & Weber, 1990). Quickly, market players, that is, the investors, stock brokers and other stake holders, realised that the interlink between the markets would lead to insurmountable benefits, including quicker information flow, supporting price efficiency and rapid adjustments in prices to reflect supply, demand and available information, therefore allowing arbitragers to exploit prices differences among markets thereby greatly increasing integration (Clemons & Weber, 1990).

It has been widely observed that electronic trading enhances efficient settlement, thereby reducing transaction processing costs with the accompanied settlement delay, and further accommodating any opportunity costs and any associated risks. Market surveillance associated with technology promotes fairness and gives dual capacity to compliance departments and regulatory bodies. This allows brokers to give the best quotes and trades for the customers for fear of losing their certificates by arranging trades at disadvantageous prices (Clemons & Weber, 1990). Different on-line trading systems are being used in stock exchanges around the world today. These include trading in batch markets where stocks are called periodically for trading, that is, orders are not crossed upon matching but accumulated and transacted in batches when stocks are called. Batch trading is suitable for inactive securities, as it minimizes their transaction and settlements costs. For example, the “a` la cri`ee” market used to determine a single price that would clear existing orders used at the Paris bourse (Haung & Stoll, 1992).

In addition, in continuous markets transactions are completed whenever two orders are matched, therefore allowing immediate transactions and continuous price formation throughout operating hours. This system benefits actively traded securities (Haung & Stoll, 1992). Worldwide, major equity markets have opted for this system which is divided into dealer markets and auction markets. In dealer markets, transactions occur between dealers (Haung & Stoll, 1992). Valdez (2003) has identified three dealing systems, namely Order-Driven systems, Quote-Driven systems and Mixture between the first two (Hybrid systems).

In the order-driven system, an intermediary matches orders (buy and sell) at a given price. In case securities are not bought or sold the broker does not take the risk so long as there is no counterparty with a similar deal on the other side. Traditionally, in the physical floor a broker for a given security would be surrounded by others calling out buy and sell orders then after the prices and orders have been matched the official price would be declared which would last until the next session. This is not so today; in Toronto there is the Computer Assisted Trading System (CATS), in Paris, there is Cotation Assist`ee en Continu (CAC) also known as Nouveau Syste`me de Cotation (NSC) or supercac which is also in use in Sao Paulo, Brussels, Lisbon and Warsaw.

In the quote-driven systems, a market dealer continuously quotes the bid and offer prices at which they will buy and offer securities. The difference is the profit margin. In this system, shares are bought at bid price and at times sold short, meaning, the shares can be bought without knowing for whom they are sold and the dealer can sell shares he does not own hence involving considerable risk if he does not get a buy to fill up. The quotations can also change depending on the market maker making the market unstable. The main quotation driven markets are the US National Association of Securities Dealers (NASDAQ) and London’s Stock Exchange Automated Quotations (SEAQ).

The hybrid system is a combination of both the order-driven and quote-driven systems. This market works through specialist who executes orders for other brokers. However, sometimes, the specialist may act on his own

account thus acting as a market maker buying from the public when there are no other buyers and selling to the public when there are no other sellers at the price of the last transaction. These are markets where public trade orders are directly matched against one another. In these markets transactions occur between dealers in dealer markets. Tokyo, Paris and Toronto operate on a continuous auction system (Huang & Stoll, 2003).

Several changes have taken place in stock exchanges. According to Ngugi (2003), the NSE's history can be traced back to the 1920s when shares were traded in an informal manner and later the formalization during the period 1954-1963 and eventually the adoption of the live trading by the automated trading systems on the 11th September 2006. Unlike in electronic trading, floor trading, however, was characterised with a loud and boisterous manual trading process with a cloud of traders clustered around the trading booths for price negotiation and improvement (Milling & Zimmermann, 2010).

Al-khouri and Al-Ghazawi (2008) have observed that shares and corporate bonds of the few listed companies on the Jordanian capital market in the late 1970s were traded Over-the-Counter (OTC) in an irregular market. However, with several reforms, Amman Stock Exchange (ASE) put in place an Electronic Trading System (ETS) on 26th March, 2000. Before October 27th, 1986, when electronic trading was introduced and London Stock Exchange (LSE) underwent the "big-bang", it was using the floor trading. The same can be said of Toronto Stock Exchange (TSE) before 1977, Tokyo Stock Exchange (TKSE) before 1982 and the Paris Stock Exchange before 1986 (Huang & Stoll, 1992).

According to Jian (2005), rapid technological advancements in telecommunications and the internet are transforming the basic business model of stock exchanges. He says, since the first exchange to introduce electronic trading was TSE in 1977, the pattern of global shift from floor trading to automatic screen-based trading in the leading exchanges in 120 countries has been exponential. Many researchers and industry experts predicted the adaptation of electronic trading to be the future of trading venues (Loh & Ong, 98). McAndrews and Stefanadis (2000) and Loh and Ong (1998) note that the last decade has witnessed a tendency towards more and more electronic trading in the US and Worldwide Securities markets and that more resources are being invested to expand the market trading platforms.

Other than technology and the need thereof, institutional investors have accelerated the evolution of the stock markets. West (1971) opines that the growth of institutional investors has already played a major role in stimulating far reaching changes in the equities market. He argues that the essential feature of the future stock market will be on negotiated dealings between institutional investors and broker-dealers who possess the capital and information systems. Milling and Zimmermann (2010) note that the evolution in the stock market involves a computer which replaces the trading floor and assumes the matching of orders between buying and selling brokers and also the developed technological possibilities of the last decade as well as the rise in institutional investors.

In the evolution process, Clemons and Weber (1990) have identified four factors and/or forces that have helped determine the evolution of securities trading. These are: the increased reliance on the use of information technology where the market demands greater liquidity, low transaction and settlement, and more hedging techniques which have been included in information technology mechanisms. The fourth factor is the increase in competition among exchanges as technology erodes geographical differences. Additionally, the increasing internationalization of investor behaviour whose gross traded equities in the stock exchanges has increased rapidly as they make cross-border investments. Another factor is deregulation or liberalization of major stock exchanges.

Other factors that contribute to stock market development in Africa include demutualization of exchanges which involves changing the legal status of stock exchange to a limited company, the ownership structure and general governance to adhere and embrace more the best practices in corporate governance, regional integration of exchanges, promotion of institutional investors, regulatory and supervisory improvements, involvement of foreign investors and provision of training and educational programs (Adjasia & Yartey, 2007). Moreover, investors are attracted to a particular market when there is stable liquidity (Nacuer *at el.*, 2007; Clemons & Weber, 1990; Capasso, 2006), ability to absorb large trades, efficiency in price and execution, access to information and information and when there is perceived and actual fairness particularly to retail investors in terms of rights and privileges of the non-member and non-insider (Clemons & Weber, 1990). These have not been fully achieved in African stock markets, explaining the existence of small fragmented markets with the exception of South Africa (Ntim *at el.*, 2011).

Towards achieving strong securities exchanges, African securities exchanges have been making integration efforts; for example, under the auspices of West Africa Economic and Monetary Union (WAEMU), the 8 West Africa French-speaking countries, including Benin, Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo, have formed the Bourse Re'gionale Des Valeurs Mobilie'res (BRVM) headquartered in Cote d'Ivoire and has computerized satellite links (Adjasia & Yartey, 2007).

With the maiden steps towards the re-establishment of the East Africa Community (EAC), the member countries of the Eastern Africa Community founded the East African Securities Regulatory Authority (EASRA) by signing

a Memorandum of Understanding (MOU) to bring together the security exchanges of the East African Member countries, that is, Kenya, Uganda, and Tanzania initially in 1997 and later the inclusion of Rwanda (2008) and Burundi which is yet to sign the MOU. The main objectives of the regulatory authority are for Information sharing among the members, Mutual assistance and cooperation between members and advancing integration of the East African capital markets. To further enhance the regionalization of the capital markets and by extension the securities exchange, the members states of East Africa formed the East African Securities Exchanges Association (EASEA) with the objectives of providing a roadmap for integration of the East Africa markets, serve as a policy advocacy document, secure funding from market development partners and align the EASEA vision with individual securities exchanges' corporate plans, EAC individual country strategic visions', plans and the EAC treaty. It is believed that the integration the East African securities exchange will contribute and facilitate economic growth and development.

Individually, the Dar-es-Salaam Stock Exchange (DSE) was incorporated in 1997 and became operational in 1998. It operates two market segments, that is, the Main Investments Markets Segments (MIMS) and the Enterprise Growth Market Segment (EGMS) which caters for medium growth oriented companies. The DSE conducts trading at the trading floor under the Automated Trading Electronic System (DATES) where bids and offers are matched through the electronic matching system. The ATS enables the DSE and the Capital Markets and Securities Authority (CMSA) to detect any market malpractices on-line and on-site including false trading, market manipulation, insider trading and short selling among others. The establishment of the CDS in 1999 has enabled reduction of clearance and settlement periods to reduce from T+5 to T+3.

Uganda securities exchange (USE) was established in June 1997 and began formal operations in January 1998. Trading is conducted through the traditional continuous open outcry auction system. Information available indicates that a central depository system was to be established by 2009. Like most security markets in Africa which do not have a variety of securities to trade, USE trades in corporate and government bonds and equities. Currently, the settlement system is based on the T+5 cycle. There are a total of 14 companies listed of which 5 are Kenyan companies cross-listed.

Rwanda Stock Exchange (RSE) is the latest East African stock exchange to be established on 7th October 2005. The exchange was demutualised from the start. Notably, RSE has the shortest delivery and settlement period of T+2. There are 4 companies listed of which 2 are Kenyan companies cross-listed. The bourse trades through an Automated Transfer System (ATS). Burundi which is considered among the East Africa member states does not have a stock exchange yet.

As indicated earlier, the Nairobi Securities Exchange (NSE) is the oldest among the East Africa Member countries having been established in 1954. It has a total of 61 companies listed. The greatest challenge to the integration process of NSE with other East Africa Member states is that it is more developed in terms of structures and experience than the other member states which will make the process of integration generally slower but facilitative for other exchanges in the region as they learn the efficiencies and use NSE as a benchmark. The NSE was demutualised in 2011 and therefore became a company limited by shares and ownership by members. Prior studies have indicated that a thriving securities exchange is an indicator of economic growth and development which is brought along by the demutualization process.

1.1.1 STATEMENT OF THE PROBLEM

On September 11, 2006, automatic trading systems went live at the Nairobi Securities Exchange (NSE). Initially, with the absence of any rules and regulations governing trading, many transactions took place through a gentleman's agreement where the parties agreed to make good delivery and settlement relevant costs. At the time, stock broking was a sideline business done by members of other professions, including accountants, auctioneers, estate agents and lawyers who met to exchange prices over a cup of coffee making it to be known as coffee-house trading.

The open outcry was preferred in order to enhance transparency where all the brokers had an equal opportunity to bid for securities and also facilitate handling the growing activity. In addition, following the recommendations of International Finance Corporation (IFC)/Central Bank of Kenya (CBK) (1984), brokerage business was conducted behind closed doors; therefore, the NSE was not able to generate adequate public awareness and confidence in the buying and selling of securities. Equally, there was no guarantee that the prices obtained by the buyers and sellers were best since all buying and selling interests did not get exposed to one another (Ngugi, 2003). It was noted that transfers took a week or two to be effected; this was a long period for investors as it wasted a lot of time between actual sale and confirmation. This adversely affected liquidity and efficiency in the market.

To solve this problem, a Central Depository System (CDS) was proposed to be installed. With the installation of the CDS, it was hoped that there would be liquidity and efficiency in the trading system thus reducing the period of delivery and settlement. It was expected that with the electronic transfer of ownership and without physical movement of certificates and minimization of systematic risk the settlement period would increase volume (Ngugi, 2003). The CDS was to enable the Delivery vs Payment system (DvP) of transactions within 5 days of

trade occurring and provide shareholders with shares within 7 days of settlement thus enabling an environment to electronic settlement and registry. According to the US Securities and Exchange Commission (SEC), information and communications technology are critical for healthy and efficient primary and secondary markets. The technological advances have resulted in markets that are efficient, transparent and better able to handle increased trading volumes.

The developing countries' stock markets have had many impediments to their development. These challenges include inadequate supervisory and regulatory systems, few coupled with insufficient variety of stocks and securities to be traded, poor informational and disclosure deficiencies, little or no incentives to list at the exchanges thus only a few institutions are listed, turmoil, wars and internal aggression which retard the gains made in the whole economic system, lack of capacity and technology, poor market infrastructure among others All these have resulted in slow growth of stock exchanges across the developing countries around the world, though they have been noted as the fastest growing in terms of market capitalization and listed companies surpassing the developed countries (Naceur *et al.*, 2007; Naceur *et al.*, 2008; Ntim *et al.*, 2011).

Though most studies conducted around the world and in Africa have indicated that electronic trading has indeed specific benefits for the traders and investors alike and in fact with the advent of technology these markets are seeking to leap faster in order to gain the benefits of automating (Stoll, 2005; Steil, 2001; Maghyereh & Omet), some are still trading through the trading floor and equally making clearing and settlement manually with majority still using local reporting standards (Adjasia & Yartey, 2007) instead of international standards.

Despite the recognition of the obvious benefits seen in other economies, specifically electronic trading over time and in particular since its inception at the Nairobi bourse, there have been limited or no efforts made to establish the effect of the use of electronic trading on various aspects of listed companies.

The objective of the study is to examine the effect of automation on trading volume of listed companies on the Nairobi Securities Exchange

1.1.1.1 LIMITATION OF THE STUDY

Since demutualization at the NSE in 2011, data collection has become expensive as opposed to when it was organized as a mutual set. Despite the fact that the demutualization will infuse some good practices of corporate governance, it does hinder further study at the NSE since to obtain data is costly.

1.1.2 MATERIALS AND METHODS

The research design used was causal-comparative design. The aim was to establish the effect of ATS on trading volume of listed companies. The target population was 61 listed companies under the Main Investment Market Segment (MIMS) and the Alternative Investment Market Segment (AIMS). The study focused on those companies that have traded continuously since 2003 to 2009. Any listed company that discontinued trading or was suspended from trading for any reason or listed shortly before, that is, after 2003 or after the implementation of the ATS, was ignored. The reason for selection of a few companies from the sample frame was because the listed companies selected represent the various variants of dynamic market sectors whose trading volume can be affected and therefore was able to provide a better and broader picture of how ATS has affected trading volume of their securities at the NSE. The research used secondary data from daily total monthly volumes of equities between the stated periods.

The data obtained was initially tabulated using Microsoft Excel spread sheets by dividing and grouping the data between the trading volumes before after the introduction of ATS. The data for the period before the introduction of automatic trading was represented by "X_1" and after the introduction of electronic trading was coded as X_2. To establish any correlation or relationship in the data, the study used the paired t-test which gives an indication of how separate two sets of measurements are, allowing for the determination of whether or not the distribution has changed in the measurement.

The paired t-test formula applied was:

$$t= \{((X_1-X_2)/2) / (\sigma/\sqrt{(n)})\} \quad (1)$$

Where X_1 and X_2 are the distribution for before and after the introduction of electronic trading, σ is the standard deviation of the differences and n is the number of pairs. The standard deviation is presented as

$$(\sigma) =\sqrt{((\sum (X_1-X_2)^2)-(\Sigma (X_1-X_2))^2/n)/(n-1))} \quad (2)$$

1.1.3 RESULTS AND DISCUSSION

As mentioned earlier, secondary data was obtained from NSE for the period between 9th September 2003 to 10th September 2009 because the launch of the Automatic trading system was on September 11th, 2006 preceding the open outcry system. The data obtained from the NSE gave information on the listed companies from which 41 were selected which had had consistent presence and trading at the market and whose total daily volumes of equities traded by each company in the periods were used in the analysis.

PERCENTAGE VOLUME TRADED UNDER OPEN OUTCRY AND ATS

The tables below give longitudinal view of the changes in volumes traded over the years in each sector per

company. We observe that there is an exponential increase after the introduction of automatic trading systems. However, other factors may have contributed to a sudden increase in the volumes which this study did not capture.

Table 1: Agricultural Sector per Company

	9th Sep 2003 -10th sept 2004		11th Sep 2004 -10th sept 2005		11th Sep 2005 - 11th sept 2006		11th Sep 2006 -10th sept 2007		11th Sep 2007 -10th sept 2008		11th Sep 2008 -10th sept 2009	
Agricultural	2004	%	2005	%	2006 (OOS)	%	2006(ATS)	%	2008	%	2009	%
Kakuzi Ord.5.00	1,617,295	0	3,090,966	0	3,893,295,582	0	7,967,390,137,497	100	869,016	0	643,035	0
Rea Vipingo Plantations Ltd O	8,154,858	0	12,900,789	0	18,479,854,131	0	37,817,932,140,306	100	5,521,272	0	1,164,171	0
Sasini Tea & Coffee Ltd Ord	5,135,736	0	5,963,650	0	8,820,482,928	0	18,049,912,900,524	100	9,891,725	0	27,917,032	0

Source: Nairobi Securities Exchange, 2012

Table 2: Commercial and Services Sector per Company

COMMERCIAL AND SERVICES	9th Sep 2003 -10th sept 2004		11th Sep 2004 -10th sept 2005		11th Sep 2005 - 11th sept 2006		11th Sep 2006 -10th sept 2007		11th Sep 2007 -10th sept 2008		11th Sep 2008 -10th sept 2009	
	2004	%	2005	%	2006 (OOS)	%	2006(ATS)	%	2008	%	2009	%
Car & General (K) Ltd Ord 5	131,495	0	210,186	0	291,321,960	0	596,172,369,174	100	989,948	0	85,108	0
CMC Holdings Ltd Ord 5.00	3,104,671	0	8,883,135	0	17,192,197,888	0	35,180,749,305,851	100	164,962,871	0	46,680,482	0
Kenya Airways Ltd Ord 5.00	59,630,542	0	71,585,823	0	111,485,896,865	0	228,141,636,124,212	100	47,850,999	0	19,626,127	0
Marshalls (E.A.) Ltd Ord 5.0	512,717	0	676,664	0	927,167,478	0	1,897,308,106,421	100	217,774	0	126,100	0
Nation Media Group Ord. 5.0	5,100,856	0	5,086,442	0	8,148,241,736	0	16,674,014,284,010	100	6,241,990	0	5,395,998	0
Tourism Promotion Services L	1,537,403	0	1,182,860	0	466,560,213	0	955,262,878,803	100	9,284,244	0	2,674,645	0

Source: Nairobi Securities Exchange, 2012

The trend is the same in the commercial and services sector with exception of CMC Holdings which does not reverse in trading volume.

Table 3: Finance and Investment Sector per Company

FINANCE AND INVEST.	9th Sep 2003 -10th sept 2004		11th Sep 2004 -10th sept 2005		11th Sep 2005 - 11th sept 2006		11th Sep 2006 -10th sept 2007		11th Sep 2007 -10th sept 2008		11th Sep 2008 -10th sept 2009	
	2004	%	2005	%	2006 (OOS)	%	2006(ATS)	%	2008	%	2009	%
Barclays Bank Ltd Ord 10.00	13,242,346	0	8,651,376	0	17,790,438,186	0	36,403,968,715,803	100	69,541,088	0	32,287,401	0
C.F.C Bank Ltd ord.5.00	4,001,265	0	2,837,617	0	5,255,310,155	0	10,754,071,420,428	100	9,610,278	0	22,790,946	0
Diamond Trust Bank Kenya L	8,304,565	0	6,703,900	0	11,994,423,175	0	24,544,447,333,441	100	15,864,955	0	3,694,210	0
Housing Finance Co Ltd Ord	12,138,282	0	9,088,220	0	22,265,550,779	0	45,561,183,384,823	100	44,384,871	0	8,485,895	0
I.C.D.C Investments Co Ltd (	2,384,269	0	1,501,592	0	3,121,461,104	0	6,387,401,189,868	100	88,778,268	0	15,461,904	0
Jubilee Insurance Co. Ltd Orc	1,676,078	0	1,292,378	0	2,645,989,641	0	5,414,396,039,098	100	3,989,680	0	578,654	0
Kenya Commercial Bank Ltd	21,731,691	0	22,014,075	0	36,964,149,144	0	75,641,849,355,162	100	424,388,828	0	175,844,010	0
National Bank of Kenya Ltd (	13,154,106	0	16,621,095	0	27,089,068,265	0	55,435,037,948,208	100	26,480,716	0	5,372,225	0
NIC Bank Ltd 0rd 5.00	10,587,643	0	3,965,770	0	9,273,706,670	0	18,976,170,849,811	100	26,887,009	0	10,018,718	0
Pan Africa Insurance Holdings	3,297,105	0	11,029,409	0	13,125,433,239	0	26,860,572,473,924	100	2,343,659	0	482,943	0
Standard Chartered Bank Ltd	9,975,223	0	7,160,872	0	13,007,669,528	0	26,617,730,106,468	100	7,838,225	0	5,053,058	0

Source: Nairobi Securities Exchange, 2012

The companies trading in the finance and investment sector followed suit with the rest of sectors.

In the Industrial and Allied Sectors two companies were not significantly affected in their trading in the year 2008 and 2009, i.e. the East Africa Portland Cement and Kenya Power & Lightning Co. Ltd. These are partly owned by the government and have had a long history of existence. In the case of Kenya Power & Lightning Co. Ltd., it operates as a monopoly in power supply hence unhindered by competition; therefore, it performed well.

All the companies in the Alternative Investment Market Segment showed significantly low trading in the year 2008 to 2009; Express Ltd. indicated the highest decline from 7.3 million equity trades to 660 thousand equity trades. Though Limuru Tea Co. Ltd. increased its equities trading from 200 to 800 it cannot be considered an active market player because of its sparse trading.

STATISTICAL DIFFERENCES BETWEEN OPEN OUTCRY AND AUTOMATIC SYSTEMS

To examine any statistical differences between the means of volumes traded before and after the introduction of automatic trading systems, we computed a paired (sample) t-test.

Table 4: t-Statistic from Companies in the Agricultural Sector

Agricultural	Pair	t value	Sig. (2-tailed)
Kakuzi Ord.5.00	Pair 1 Before ATS -After ATS	-1.958	0.189
Rea Vipingo Plantations Ltd Ord 5.00	Pair 2 Before ATS -After ATS	-0.119	0.916
Sasini Tea & Coffee Ltd Ord 5.00	Pair 3 Before ATS -After ATS	-2.753	0.111

Source: Nairobi Securities Exchange, 2012

From the calculated p-values Kakuzi Ltd and Sasini Tea and Coffee Ltd showed significant differences in their values meaning that there was a change in the volumes traded after the installation of the ATS.

Table 5: t-Statistic from Companies in the Commercial and Services Sector

Commercial and Services	Pair	t value	Sig. (2-tailed)
Car & General (K) Ltd Ord 5.00	Pair 1 Before ATS -After ATS	-1.191	0.356
CMC Holdings Ltd Ord 5.00	Pair 2 Before ATS -After ATS	-1.729	0.226
Kenya Airways Ltd Ord 5.00	Pair 3 Before ATS -After ATS	-0.226	0.842
Marshalls (E.A.) Ltd Ord 5.00	Pair 4 Before ATS -After ATS	5.548	0.031
Nation Media Group Ord. 5.00	Pair 5 Before ATS -After ATS	-0.721	0.546
Tourism Promotion Services Ltd Ord 5.00 (Serena)	Pair 6 Before ATS -After ATS	-0.398	0.729

Source: Nairobi Securities Exchange, 2012

In the commercial and services sector as shown in Table 5 above all companies showed significant differences in the trading volumes during the period before and after the ATS other than three.

Table 6: t-Statistic from Companies in the Finance and Investment Sector

Finance and Investment	Pair	t value	Sig. (2-tailed)
Barclays Bank Ltd Ord 10.00	Pair 1 Before ATS -After ATS	-2.326	0.146
C.F.C Bank Ltd ord.5.00	Pair 2 Before ATS -After ATS	-2.847	0.104
Diamond Trust Bank Kenya Ltd Ord 4.00	Pair 3 Before ATS -After ATS	-0.795	0.51
Housing Finance Co Ltd Ord 5.00	Pair 4 Before ATS -After ATS	-1.124	0.378
I.C.D.C Investments Co Ltd Ord 5.00	Pair 5 Before ATS -After ATS	-1.299	0.324
Jubilee Insurance Co. Ltd Ord 5.00	Pair 6 Before ATS -After ATS	-1.016	0.417
Kenya Commercial Bank Ltd Ord 10.00	Pair 7 Before ATS -After ATS	-1.893	0.199
National Bank of Kenya Ltd Ord 5.00	Pair 8 Before ATS -After ATS	-0.541	0.643
NIC Bank Ltd 0rd 5.00	Pair 9 Before ATS -After ATS	-1.644	0.242
Pan Africa Insurance Holdings Ltd	Pair 10 Before ATS -After ATS	-1.044	0.406
Standard Chartered Bank Ltd Ord 5.00	Pair 11 Before ATS -After ATS	-0.407	0.723

Source: Nairobi Securities Exchange, 2012

In this sector, there were differences in the trading volumes after the introduction of the ATS.

Table 7 below presents companies in the manufacturing sector. Whereas there are no known specific factors attributable to the high significant p-values for Athi-River Mining, Bamburi Cement and Crown Berger which registered 0.926, 0.719 and 0.8 respectively, the rest of the companies indicated significant differences in the trading of equities.

Table 7: t-statistic From Companies in the Industrial and Allied Sector

Industrial and Allied	Pair	t value	Sig. (2-tailed)
Athi River Mining Ord 5.00	Pair 1 Before ATS -After ATS	-0.105	0.926
Bamburi Cement Ltd Ord 5.00	Pair 2 Before ATS -After ATS	-0.415	0.719
British American Tobacco Kenya Ltd Ord 10.00	Pair 3 Before ATS -After ATS	-0.904	0.461
Crown Berger Ltd 0rd 5.00	Pair 4 Before ATS -After ATS	-0.289	0.8
Dunlop Kenya Ord 5.00	Pair 5 Before ATS -After ATS	0.909	0.459
E.A. Cables Ltd Ord 5.00	Pair 6 Before ATS -After ATS	-1.015	0.417
E.A. Portland Cement Ltd Ord 5.00	Pair 7 Before ATS -After ATS	-0.999	0.423
East African Breweries Ltd Ord 10.00	Pair 8 Before ATS -After ATS	-0.999	0.423
Firestone East Africa Ltd Ord 5.00	Pair 9 Before ATS -After ATS	-0.999	0.423
Kenya Oil Co Ltd Ord 5.00	Pair 10 Before ATS -After ATS	-0.999	0.423
Mumias Sugar Co. Ltd Ord 2.00	Pair 11 Before ATS -After ATS	-0.999	0.423
Kenya Power & Lighting Ltd Ord 20.00	Pair 12 Before ATS -After ATS	-0.999	0.423
Total Kenya Ltd Ord 5.00	Pair 13 Before ATS -After ATS	-0.999	0.423
Unga Group Ltd Ord 5.00	Pair 14 Before ATS -After ATS	-0.999	0.423

Source: Nairobi Securities Exchange, 2012

Table 8: t-statistic From Companies in the Alternative Investment Market Segment

Alternative Investment Market Segment	Pair	t value	Sig. (2-tailed)
City Trust Ltd Ord 5.00	Pair 1 Before ATS -After ATS	-0.999	0.423
Eaagads Ltd Ord 1.25	Pair 2 Before ATS -After ATS	-0.999	0.423
Express Ltd Ord 5.00	Pair 3 Before ATS -After ATS	-0.999	0.423
Williamson Tea Kenya Ltd Ord 5.00	Pair 4 Before ATS -After ATS	-0.999	0.423
Kapchorua Tea Co. Ltd Ord 5.00	Pair 5 Before ATS -After ATS	-0.999	0.423
Kenya Orchards Ltd Ord 5.00	Pair 6 Before ATS -After ATS	-0.524	0.653
Limuru Tea Co. Ltd Ord 20.00	Pair 7 Before ATS -After ATS	-0.988	0.427

Source: Nairobi Securities Exchange, 2012

In Table 8, City Trust Ltd., Eaagads Ltd., Express Ltd., Williamson Tea Kenya Ltd. and Kapchorua Tea Co. Ltd. showed similar significant p-value differences of 0.425 like in Table 9, though they indicated significant differences in the use of the trading systems. The similar figures are attributable the accommodation of data figure inefficiencies while calculating the p-values. Nevertheless, in the sector only Kenya orchards Ltd. indicated that there were no significant differences in the trading systems.

The data was also manipulated per sector to ascertain if there was any consistency with the data as per company obtained above. Critical examination of the total daily volumes of equities traded by the listed companies for the period in question was carried out. The monthly volumes were then cumulated to give a comparative picture of annual equities traded by the companies. It is important to note that the data corresponds respectively to the time systems used at the floor of Nairobi Securities shifted from open outcry to automated trading systems.

Table 9: Volumes traded annually per sector for listed companies during Open outcry system

Sector	Cumulative volumes traded annually during Open outcry system			
	2003	2004	2005	2006 (A)
Agricultural	5,500,226	13,263,806	21,999,655	14,683,908
Commercial and services	17,291,879	83,207,563	93,749,977	103,324,719
Finance and Investment	38,009,659	83,111,653	117,264,873	146,990,188
Industrial and allied	65,026,450	396,020,235	458,513,598	282,966,589
Alternative investment market segment	329,415	7,329,537	16,830,137	12,576,080

Source: Nairobi Securities Exchange, 2012

Unlike in the previous system the companies trading seem to have a fairly similar trend in trading. In sectors where a single company seemed to be constantly handling the biggest trading volumes, other companies suddenly emerged Sasini Tea and Coffee limited whose ordinary share goes for Kes 5 joined Rea Vipingo plantations limited in trading higher volumes.

Table 10: Volumes Traded Annually Per Sector for Listed Companies during Automated Trading Systems

Sector	Cumulative volumes traded annually during Automatic trading systems			
	2006 (B)	2007	2008	2009
Agricultural	22,877,707	26,085,288	14,923,186	25,929,648
Commercial and services	53,731,779	201,631,383	194,717,031	49,003,546
Finance and Investment	70,099,965	677,789,549	603,001,307	176,347,730
Industrial and allied	196,945,866	401,001,421	433,854,345	193,410,992
Alternative investment market segment	9,109,743	12,837,636	5,301,156	872,880

Source: Nairobi Securities Exchange, 2012

A critical analysis of the difference per sector reveals that the agricultural, commercial and services and finance and investment sectors each traded at least 30% more volumes after the launch of Automatic trading systems. The industrial and Allied sector only traded a 1.8% change in volumes. The alternative investment market segment traded fewer volumes by 30% as indicated in Table 11 below.

Table 11: Changes in Volumes Traded Per Sector

Sector	Volumes traded during		% Change in Volumes traded per sector
	Open outcry systems	Automatic Trading systems	
Agricultural	55,447,595	89,815,829	38.27%
Commercial and services	297,574,138	499,083,739	40.38%
Finance and Investment	385,376,373	1,527,238,551	74.77%
Industrial and allied	1,202,526,872	1,225,212,624	1.85%
Alternative investment market segment	37,065,169	28,121,415	-31.80%

Source: Nairobi Securities Exchange, 2012

Over and above, 34 companies in the various sectors listed in the Nairobi Securities Exchange, traded more volumes during the launch of the automatic trading system. There were slight decreases within the 7 listed companies in the alternative investment market segment after the system. This findings were consistent with the per company per sector findings earlier; however, they were pretty inconsistent particularly in the Alternative Investment market which also found positive correction that with the new Automated system there was an increase in volumes traded.

Table 12: Correlation statistics

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Total Volumes traded during Open Outcry systems	494.50	4	254.053	127.027
	Total Volumes traded during Automatic Trading systems	842.50	4	513.668	256.834

Source: Menge Osero, 2012

It is important to note that since much change after the launch of ATS in securities volumes, the null hypotheses tested during the correlation was that no change in volumes traded by the companies occurred. A critical look at the p-values computed indicates that indeed there were changes in the volumes transacted. Note that for all sectors and cumulative annual volumes traded P values > .005 which called for rejection of the null hypothesis. Generally, when looking at the cumulative trading of volumes, there was significant change in the volume of shares trades as indicates in the Table 15 below.

Table 13: Correlation Results Comparing OO and AT Systems

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Total Volumes traded during Open Outcry systems - Total Volumes traded during Automatic Trading systems	-348	373.26	186.63	-941.941	245.941	-1.865	3	0.159

Source: Author, 2013

Other than the Industrial & Allied and the alternative Investment Sector which showed that there were no significant differences between the systems the rest of the sectors showed there were significant differences between the systems when the volumes are computed per sector as shown in table 15 below.

Table 14: Correlation results comparing OO and AT systems per sector

Paired Samples Test results per sector

		Paired Differences					t	df	Sig. (2-tail)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Volumes traded in the Agricultural sector during OO systems - Volumes traded in the Agricultural sector during ATS	-10	12.489996	6.244998	-29.874371	9.8743708	-1.601282	3	.208
Pair 2	Volumes traded in the Commercial and services sector during OO systems - Volumes traded in the Commercial and services sector during ATS	-50.75	78.197933	39.098966	-175.18036	73.680361	-1.297988	3	.285
Pair 3	Volumes traded in the Finance and investment sector during OO systems - Volumes traded in the Finance and investment sector during ATS	-285.5	297.16494	148.58247	-758.35573	187.35573	-1.921492	3	.15
Pair 4	Volumes traded in the Industrial and Allied sector during OO systems - Volumes traded in the Industrial and Allied sector during ATS	-5.5	93.189771	46.594885	-153.78572	142.78572	-0.118039	3	.913
Pair 5	Volumes traded in the alternative investment market segment sector during OO systems - Volumes traded in the alternative investment market segment sector during ATS	2.425	11.181346	5.590673	-15.367017	20.217017	0.433758	3	.694

Source: Author, 2013

1.1.4 CONCLUSION

The development in technology is causing unprecedented changes in the manner trading is done. Although trading systems are complex and expensive and particularly those used in the stock market or exchanges, many countries around the world both in the developed and the emerging markets have adapted automatic trading systems and those that have not, are hastening to create structures and mobilize resources to install them.

By and large markets that have installed electronic systems find it easier to trade across the borders integrating

markets and extending to bring efficiency and hence leading to high volume trades. From the research there is evidence that the change of systems from the old open outcry to Automatic systems have a significant relationship, i.e. after the adaption of the new system volumes of trade surges up. Though certain other organizational specific factors affect trading as well as macro and micro economic factors which may lead to low trading for some companies as indicated earlier.

1.1.4.1 RECOMMENDATIONS

In the process of demutualization, the NSE should consider allowance for further study of the goings-on at the NSE through exempting students and scholars to obtain data free or at a significantly nominal fee. This will encourage further inquiries and investigations in order to improve on efficiency in trading. Moreover, the low trading at the NSE and/or even the listing of companies is due to low knowledge and the stringent rules and regulation for listing. This makes it difficult to estimate the real market capitalization of companies. It is, therefore, recommended that stock trading and investment trading through the NSE be emphasized. In addition, since the automated systems deny the market players the opportunity of price formation and discovery, it is recommended that the process of market marking be integrated in order to accommodate the retail investors who consider price unlike the institutional investors. Further studies should also be done for a longer period backwards and forwards to establish if the trends in trading changed after 2009. With due consideration, the ATS may not be the only factor affecting increased trading at the NSE.

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Table 1. The capitals, assets and revenue in listed banks

	Total capital stock	Income of main business	Total assets
Pudong Development Bank	39.2	214.7	5730.7
Bank of China	459.4	3345.7	59876.9

Description for the above table.

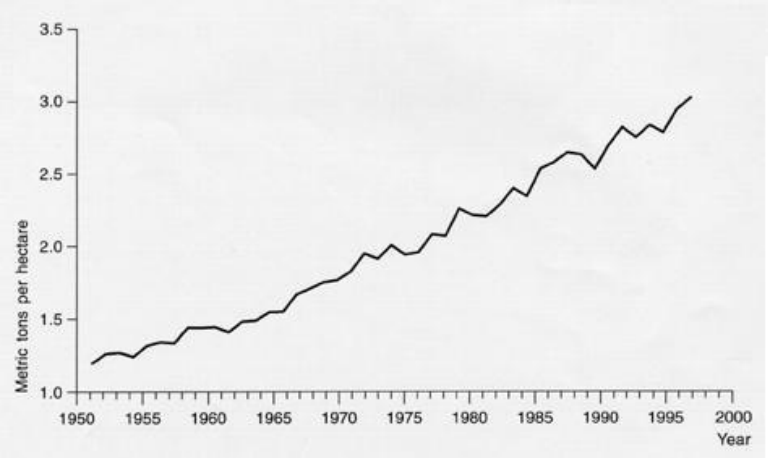

Figure 1. The Trend of Economic Development Description for the above figure.

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