UNIVERSITY OF NAIROBI.

THE EFFECTS OF MARKET MICROSTRUCTURE CHANGES ON PERFORMANCE: A CASE OF AUTOMATION OF NAIROBI STOCK EXCHANGE.

BY

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DECLARATION

This management research project is my original work and has not been presented for a degree in any university.

SIGNED _____ DATE 19/11/2008

Joel Irungu Mukumu
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This management research project has been submitted for examination with my approval as university supervisor.

SIGNED _____ DATE 19/11/2008

CYRUS IRAYA
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DEDICATION

TO

Andrew Mukumu my father, Milka Wanja my late mother and my aunt Beatrice Mumbi.

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ABSTRACT

The aim of this study was to assess the improvement in functioning of the Nairobi Stock Exchange (NSE) following the implementation of new technology and automation of the trading system. The market had previously been operating on floor based trading system until 11 September, 2006, when it was automated. The study used historical market data. Return and volume residues and turnover ratios were calculated within the event window period of 31 days. The analysis was done by comparing the mean and turnover ratio before and after introduction of automated trading system. The market was separated between Main Investments Market Segments (MIMS) and Alternative Investments Market Segments (AIMS).

The research found out that there exist no significant difference in terms of returns, volumes, and liquidity before and after automation. The research therefore concluded that the effect of automation has not been factored in the market.

In conclusion therefore, the failure by NSE automation to address the interest of the investors of transparency and immediacy raises concern as to the benefits of microstructure reforms within the short term.

1. INTRODUCTION

1.1 Background

Market microstructure deals with financial intermediation in the process of trading a financial asset, such as a stock or a bond. In a trading market, assets are not transformed (as they are, for example, by banks that transform deposits into loans) but are simply transferred from one investor to another. The financial intermediation service provided by a market, first described by Demsetz (1968) is immediacy. An investor who wishes to trade immediately is a demander of immediacy and one does it by placing a market order to trade at the best available price; the bid price if selling or the ask price if buying. Suppliers of immediacy establish the bid and ask prices. Depending on the market design, supplies of immediacy may be professional dealers that quote bid and ask prices or investors that place limit orders or some combination.

The use of electronic trading has expanded rapidly in recent years, from liquid and homogeneous instruments on organized exchanges, such as stocks and futures, to a wide variety of instruments in foreign exchange and fixed income markets. The introduction of electronic trading has the potential to change the way the market functions. Such platforms increase the operational and informational efficiency of the market through reduction in transaction costs and improvements in market access and transparency. However, increased competition could reduce dealers' incentive to make markets and adversely affect the market depth (Jiang, 2002).

The strict advocates of efficient market hypothesis believe that prices on traded assets, such as stocks, bonds or property, already reflect all known information and therefore are unbiased in the sense that they reflect the collective beliefs of all the market participants about the assets and their future prospects. Fama (1970) described an efficient market as having prices that "fully reflect" available information. However many studies (on various markets, including Nairobi Stock Exchange), have revealed that prices of the assets do not always follow a random walk and therefore can be predicted. Examples of such studies include Dickson and Muragu (1994) and Frino and Hill (2001). Other

considerations other than the efficient market hypothesis can dictate the stock prices. Stock Exchanges all over the world therefore are striving to enhance market efficiency. Nairobi Stock Exchange (NSE) in particular introduced Automated Trading System (ATS) on 11 September, 2006 with an aim of improving dissemination of information. (www.cma.or.ke)

Shelton (2001) reported that automated stock trading is a burgeoning research area with important practical applications. The advent of internet has radically transformed the nature of stock trading in most stock exchanges. He noted that traders can now readily purchase and sell from a remote site using internet-based order submission protocols. Additionally traders can monitor the content of buy and sell order books in real time using a web-based interface. The electronic nature of the transactions and the availability of up-to-date order book data make autonomous stock trading applications a promising alternative to immediate human involvement.

1.2 Market microstructure changes

Market microstructure changes are micro-reforms done in a market. Over the last 25 years, the subject of market microstructure has become a major sub-discipline within the field of finance. Surveys done on the subject include Stoll (1999) and Madhavan (2000). These empirical researches on market microstructure have been concerned with the major industrial countries. The development of market microstructure as a subject has coincided with a period of establishment of new stock markets and revitalization of the existing ones in many developing and transitional economies. The revitalization of these emerging stock markets is characterized by institutional reforms, including modernization of trading and information systems, expanding stock market membership, revamping the regulatory framework and opening access to foreign capital. The reforms are aimed at improving the stock market performance by increasing liquidity and transparency, enhancing efficiency, and reducing volatility and trading cost.

Amihud and Mendelson (1989) noted that liquidity and transparency are desirable because they reduce the required return by investors and therefore increase security

values. Increased liquidity improves the ability of stock markets to perform their information processing and signaling functions. Amihud (2002) argued that increased efficiency improves the aggregation and transmission of information through price signals and thus allows agents to make more informed investment decisions and spread the risks more effectively. Efficient stock prices and yield provide benchmarks against which the cost of capital for and returns on investment projects can be judged, even if such projects are not financed through the stock market (Green et al, 2000). Green et al (2000) further concluded that an efficient price discovery process is traditionally associated with lower fundamental volatility, which promotes stock market effectiveness in allocating resources. Risk-averse investors will demand a high risk premium, which increases the cost of capital and reduces market liquidity.

The main issue in the emerging markets is whether or not a costly revitalization activity has positive value in terms of liquidity, efficiency, and volatility. In studies of more established markets which have implemented reforms in trading systems, Amihud and Mendelson, (1989) report that reform had a generally positive impact, creating gains in efficiency of the price discovery process, increased liquidity and lower volatility. These include studies of Milan Stock Exchange (Amihud et al, 1990), Tokyo Stock Exchange (Amihud and Mandelson, 1991) and Tel Aviv Stock Exchange (Amihud et al, 1997). Blennerhasset and Bowman (1998) report a fall in transaction costs on the New Zealand stock exchange following the move from open outcry to screen trading, and Majnoni and Massa (2001) report broadly positive results for reforms introduced by the Italian Stock Exchange.

Majnoni and Massa (2001) further note that there are fewer studies of emerging markets and their results are more mixed. Some suggest that the entry of foreign investors is a more important factor than internal market reform (although the former may be predicted on the latter), and that this is followed by increased liquidity and enhanced efficiency in the price discovery process, while volatility increased, following the introduction of a continuous auction system in Taipei Stock Exchange. One difficult in studying emerging markets is that many of the stock exchanges are young and relatively few stocks are traded. Data from pre-reform era are often not adequate to carry out a full evaluation of

the effects of reform. However, since reform can be costly, it is particularly important to quantify its benefits in countries where there may be many apparently more pressing claims on investments resources.

1.3 The Nairobi Stock Exchange (NSE)

NSE was constituted in 1954 as a voluntary association of stock brokers registered under societies act. Since its inception the NSE has undergone various major changes. In early 1980s the government began to focus more intensely on the country's financial system. It aimed at adopting more friendly reforms to foster competition and more sustainable economic growth. These reforms gained momentum in the late 1980s with privatization program targeting the state corporations such as Kenya Commercial Bank and Kenya Airways. The NSE was chosen as the market in which shares of the government in these state corporations were floated to the public. (www.nse.co.ke/newsite/inner)

In line with government's aim to re-emphasize its commitment to the financial reform process and further boost investors' confidence, a regulatory body to oversee NSE activities, among other objectives was created through an Act of parliament, the Capital Market Authority Act (Cap 485 A) of the laws of Kenya. The key words in the objectives of creating the Capital Markets Authority were "promotion" and "facilitation" of an orderly, fair and efficient capital market in Kenya. (Kihumba, 1992)

Kibuthu (2005) reports that NSE is an example of an emerging stock market that has been characterized by humble beginning yet has grown considerably over time. It stands out as an average stock market with great potential for growth, one that is making considerable effort to be a more significant driver of the economy in Kenya and East African region. In 1994, the NSE was rated by the International Finance Corporation (IFC) as the best performing emerging market in the world with a return of 179 % in dollar terms. From 2003, the NSE experienced robust activity and high returns on investments. It is a reference point in terms of setting standards for other markets in the East African region. Kibuthu (2005) further notes that NSE as an emerging capital market

is faced with challenges to its development and growth such as economic depression and political uncertainty, among others.

1.4 Microstructure changes in the Nairobi Stock Exchange

The NSE was constituted in 1954 and registered under the Societies Act. The business of dealing in shares that was then confined to the residents of European Community was opened to Africans and Asians after the attainment of independence in 1963. A 35% capital gains tax introduced was in 1975 but was later suspended in 1985. In the 1980s the Kenyan Government realized the need to design and implement policy reforms to foster sustainable economic development with an efficient and stable financial system. In particular, the government set out to enhance the role of the private sector in the economy, reduce the demands of public enterprises on the exchequer, rationalize the operations of the public enterprise sector to broaden the base of ownership and enhance capital market development.

In 1984, a study by both International Finance Corporation and Central Bank of Kenya, on development of money and capital markets in Kenya, became a blueprint for structural reforms in the financial markets, culminating in the formation the Capital Market Authority (CMA) in 1989, to assist in the creation of an environment conducive to the growth and development of the country's capital markets. In 1991, the NSE was registered under the Companies Act and phased out the "Call Over" trading system in favour of the floor-based "Open Outcry System". The introduction of central depository and settlement system was done in 2004 while market automation was introduced in 2006 (www.nse.co.ke/newsite/inner).

1.5 Statement of the problem

Prior to automation, Nairobi Stock Exchange was faced with efficiency and transparency challenges. Automation was expected to increase the investor confidence by modernizing its infrastructure and by eliminating delays in transfer of shares, hence creating a better price discovery in the market. (www.cma.or.ke/journal). Dickson and Muragu (1994)

found the NSE to have characteristics of weak form efficiency. There was a need for the market to embrace online trading, like major capital markets to improve efficiency.

Coughenour and Shastri (1999) provide a detailed summary of empirical studies regarding the estimation of the components of the bid-ask spread, order flow properties, the Nasdaq controversy and linkages between option and stock markets. Madhavan, (1998) survey the literature on trading costs, with a focus on institutional trades. Lyons (1999) examines the market microstructure of foreign exchange markets. They all reported improved capital market trading following microstructure changes.

The main issue in stock markets is whether and how the market microstructure changes can create a positive value in terms of returns, volume and liquidity. Previous studies on more established markets, which have implemented changes in trading systems, have reported a positive impact, creating gains in market efficiency, increased liquidity, and lower volatility. Such studies in the emerging markets include Amihud et al, (1990), Amihud and Mendelson (1991) and Amihud et al, (1997).

Blennerhassett and Bowman (1998) reported a fall in transaction costs on the New Zealand stock exchange following the move from open outcry to screen trading. Majnoni and Massa (2001) report broadly positive results after implementing market microstructure changes in terms of trading regulations and transaction cost introduced by the Italian stock exchange. Chang et al (1999) found no change in liquidity or in the efficiency of the price discovery process, while volatility increased, following the introduction of a continuous auction systems.

The central idea of market microstructure change is to gain market efficiency. Stock markets are constantly thriving to implement changes in market microstructure, which is most obviously driven by the rapid structural, technological and regulatory changes affecting the securities industry world wide. The causes of these structural shifts are complex. They include the substantial increase in trading volume, competition between exchanges within the same country and regions, the introduction of electronic communications networks, changes in the regulatory environment, technological

innovations, the growth of the internet usage, and proliferation of new financial instruments. When the relevant market microstructures are changed in tandem with the said changes the market is expected to gain efficiency (Sinnakkannu and Nassir, 2006).

This research is to establish the effect on performance in terms of returns, volume and liquidity, due to market microstructure change (automation) implemented in Nairobi Stock Exchange.

1.6 Objective of the study

To establish the effect of market automation on returns, volume and liquidity of companies quoted in the Nairobi stock exchange.

1.7 Importance of the study

Investors

The finding of this study would assist investors in making more informed decisions when trading in Nairobi Stock Exchange electronically. The findings of this study would also give confidence to the general public by revealing whether electronic trading system increases the dissemination of information to market participants which enables them to have balanced information. With more information, the market becomes competitive and efficient.

Financial advisors

The findings of this study would equip financial advisors with knowledge of gains or otherwise of transparency in Nairobi stock Exchange as a result of electronic trading.

Academicians

The study would provide knowledge to scholars in the field of financial theory and will aid future research work in the area.

Capital Market Authority

Findings of this study would provide further knowledge on how automation of the trading has done and would aid the authority in making future adjustments if need be.

2. LITERATURE REVIEW

2.1 Effects of microstructure changes in emerging markets

Basweti (2002) defines emerging market as a stock market that is in transition, increasing in size, activity or levels of sophistication and carrying out structural reforms. A stock market is classified as emerging if it meets at least one of the following criteria: It is either located in a low or middle income economy as defined by World Bank or its market capitalization is low relative to the most of the recent GNP or GDP figures; It introduces investments restrictions like foreign ownership limit, extensive government involvement in listed companies and other legislated restraints particularly on foreign investors.

Stoll (1999) and Madhavan (2000), note that empirical researches on market microstructure have been concerned with the major industrial countries, particularly in USA. The development of market microstructure as a subject has coincided with a period of establishment of new stock markets and revitalization of the existing ones in many developing and transitional economies. The revitalization of these emerging stock markets is characterized by institutional reforms, including modernization of trading and information systems, expanding stock market membership, revamping the regulatory framework and opening access to foreign capital. The wider goal is to promote the development of the local capital markets and facilitate access to long –term capital. The rest of this section looks at market microstructure changes in some emerging markets, namely NSE, Hong Kong and Bursa Malaysia stock exchanges.

NSE has undertaken various reforms to improve the market efficiency. In 2000, NSE re-organized the market into four major segments namely Main Investment Market Segment, Alternative Market Investment Segments, Fixed Income Securities Market and Futures and Options Market Segment. Kamau (2001) concluded that separating the markets resulted to no significant difference in performance between the companies listed in Main Investment Market Segment and Alternative Market Investment Segments. Muriuki (2003) reported that the structure of NSE has witnessed tremendous

transformation during the last 10 years that has seen its operating environment and trading systems improve in terms of market transparency and efficiency.

Kibuthu (2005) reported the establishment of Capital Market Authority in 1989 as a body to regulate and oversee the orderly development of capital market in Kenya. The study concluded that introduction of ATS was expected to give confidence to the investors. Central Depository System introduced in 2004, radically changed how business was done at the stock exchange. It eliminated paper certificates and expedited the process of share transfers. It also improved the efficiency of the operations of the NSE.

With rapid technological advances and growing demand for a more efficient trading environment, most brokerage houses and banks in Hong Kong offer online stock trading to retail investors. While Boom securities, a Hong Kong-based stock broker, was the first company to offer online trading in Hong Kong listed companies in 1998, an increasing number of brokers and banks have been providing online stock trading facilities to clients over the past couple of years. These e-brokers, provide clients with a wide range of services including real time quotes, market analysis, and monitoring of account portfolios from a single point of access. While most e-brokers offer online trading facilities in Hong Kong listed securities, some also offer trading in US securities as well as securities from other overseas markets such as Singapore, Taiwan, Thailand and Korea.

With the implementation of the Order Routing System (ORS) by the Hong Kong Exchanges and Clearing Ltd in February, 2001, investors are able to place orders through the internet to brokers for approval and submission to the market. In this regard given that the broker systems are connected to the ORS, securities orders are passed electronically and directly from exchange to the Stock Exchange, thereby eliminating human intervention. This helps to shorten trade execution and reduce costs (Habermeier and Kirilenko, 2001).

Sinnakkannu and Nassir, (2006) report that Bursa Malaysia formerly known as Kuala Lumpur Stock Exchange(KLSE) is the premier secondary stock market in Malaysia, and

is classified as one of the emerging stock markets that exist in the Asia Pacific region. The Bursa Malaysia (KLSE) was established in 1930 and in July 1973, it was incorporated under the company's Act of 1965. The Malaysian stock market has undergone a robust development since the late 1990s. With the proliferation of privatization projects and the equity boom in 1993, market capitalization exceeded the Singapore Stock Exchange by Mid-1990s. Since then Bursa Malaysia has taken various measures in changing the market microstructure, including the introduction of computerized trading, a central depository and efficient clearing and settlement systems, to develop market infrastructure in the effort to gain market efficiency.

Further market microstructure change in the exchange was through implementation of the fully computerized screen based trading system in November, 1992. The implementation of Score (System on computerized order routing and execution) eliminated the open outcry system and hence, the use of a trading floor at the Exchange's premises. At the same epoch, the launching of Central Depository System (CDS) account opening in November 1992 marked a major milestone for Bursa Malaysia and expected to result in a more efficient settlement and clearing system. The third major market microstructure change was the establishment of Securities Commission (SC) which monitors and implement regulatory changes to enhance investors confidence and meet the requirement by statute.

Effective 1 September, 1998 Bursa Malaysia instituted incisive new measures to further enhance transparency in the stock market with changes in the rules, regulations and procedures of the exchange. In 17 April 1999, Bursa Malaysia launched a new index called the KLSE Syariah Index, to expand participation in the stock markets from local and foreign investors who were keen to invest in securities approved by Islamic principles of Syariah. In May, 1999, Bursa Malaysia became an affiliate member of the International Organazation of Securities Commissions (IOSCO). The membership was expected to serve as another platform for Bursa Malaysia to learn from other members, and also present its views and opinion in various areas of securities regulations (www. eurojournals.com/finance and www.bursamalaysia.com/bm).

On 12 May, 2000, Bursa Malaysia launched the technology sector and a corresponding technology index to track technology stock investments. The T+3 settlement cycle was implemented on 20 December in place of the previous T+5 rolling settlement system. The transition from T+5 to T+3, shortened the delivery and settlement period.

The various key market microstructure changes in the observed two years between 2000 and 2001 were very critical to enhance transparency, trading efficiency and transaction costs of not only individual investors but also for institutional investors. These changes were aimed to strengthen the stock market in terms of investor confidence and efficient price discovery at the post Asian Currency Crisis (www. eurojournals.com/finance).

Table 2.0 shows comparison of returns before and after automation for the two trading segments of an emerging market.

Table 2.0 Performance in Mumbai Stock Exchange

	63 A stocks					83 B stocks				
	Mean	Med	Std Dev	Min	Max	Mean	Med	Std Dev	Min	Max
Pre-ATS	0.03	0.03	0.01	0.01	0.06	0.04	0.03	0.02	0.01	0.14
Post-ATS	0.02	0.02	0.01	0.01	0.05	0.03	0.03	0.01	0.02	0.13
Change (Post-Pre)	(0.01)	(0.00)	0.01	(0.04)	0.02	(0.01)	(0.01)	0.02	(0.11)	0.09

Source: Green et al (2003)

2.2 Automated Trading Systems

Through its impact on trading costs and market architecture, ATS will have a profound effect on market functioning and financial stability, in terms of market efficiency, liquidity, volatility and resilience during the time of stress (Committee on Global Financial System (2001)). Habermeier and Kirileneko (2001) report reduced transitions costs and greater efficiency of ATS that facilitates trading, increases liquidity and reduces price volatile. However, competition, inform of lower costs and increased transparency due to ATS, reduces margins, leading to fewer dealers and reducing the amount of

liquidity they provide. This also reduces the bargaining power of large markets players to negotiate a better price for their positions. According to Congressional Research Service (2000), the emergency of multiple ATS platforms for trading stocks in the United States led to concerns about market fragmentations, in terms of the dispersals of trading.

ATS increases the operational efficiency in both centralised and fragmented markets. Automation of the trading process lowers order-processing costs, while the integration of the trading process makes straight through processing possible. It also reduces the search costs by automating the collection of pre-trade and post trade information and increasing the amount and timeliness of information. Fragmented markets become more centralised under ATS through increased use of multi-dealer systems and moving towards order books. ATS systems provide the technology to eliminate the intermediaries in segmented markets. The speed of price information transmission from inter-dealer markets will be improved.

Harris (2003) reported that ATS improves pricing information collections and transmission to market participants, which leads to better information efficiency. As a result of improved transparency, market prices reflect better and faster available information about fundamentals. However, the reduced number of dealers may reduce risk capital from the market place and the provision of liquidity by dealers at times of stress. Information regarding counterparty risk is more important during times of stress: The anonymous nature of many ATS platforms may affect their performance during the time of stress. As ATS affects multiple factors that influence the informational and operating efficiency of the market, the impact of ATS on market functioning and financial stability becomes an empirical question. Electronic trading can contribute to market liquidity through its impact on fairness and speed of executions, access and costs. Electronic trading enhances fairness and transparency by the system. Manual floor trading may be subject to variations in the interpretation of rules, and outright cheating. Electronic trading also removes the physical constraints to which floor trading is subject and gives equal access to all traders. Tsang (1999) compared the two systems vide the table 2.1 below.

Table 2.1 Comparison of open outcry and automated trading systems.

	Open Outcry Trading	ATS
Liquidity	Lesser liquid than ATS	Empirical evidence have found evidence that ATS may be better than open outcry System
Immediacy	Orders are changed/Cancelled faster, and Price discovery maintained in markets under stress	Systems may slow down or fail especially during the market stress
Efficiency	Different prices may exists, Human errors and bias likely	Transparent price discovery, reduced Frauds, human errors and bias
Cost	High fixed and operating costs	High development costs. Low operating costs
Anonymity	More informative about counter party	Adverse selection in block trades, limiting the growth of order size.
Global Link	Segregated exchange	24-Globally linked trading possible

Source: Adapted from Tsang(1999)

Emprical studies have been conducted to assess the effect of electronic trading systems on market liquidity. Frino et al (1998) examined the trading of bund futures on the floor-based open outcry London International Financial Futures Exchange (LIFFE) and the automated Deutsche Terminborse (DTB), which offered two different trading mechanisms operating at the same time for the same security. The paper investigated the periods during which each exchange share of total bund trading was similar and found that Bid-Ask Spreads (BAS) were wider on the LIFFE than the DTB for a given level of volatility, after controlling for trading volumes. The result implies that electronic trading systems are capable of providing higher liquidity than open outcry, but the relative performance of electronic trading systems deteriorate during periods of high volatility.

Hill (2000) examined intraday trade and quote data for the nearest to maturity share price index (SPI) futures contract traded on the Sydney Futures Exchange (SFE) for the period 30 September, to 25 October, 1999, a total of 30 trading days around the beginning of electronic trading of the contract on 4 October 1999. The study found that BASs were significantly lower on the screen-traded system, compared to the previous open outcry

market. This implies that the screen –traded market structure facilitates higher levels of liquidity than the floor-traded market, highlighting the effect of automation on the efficiency of a futures market. Frino and Hill (2001) examined the transitions of trading in stock index futures from open outcry to ATS in the LIFFE, SFE and HFKE during 1999-2000. Quote and trade data 50 days prior to the introduction of the electronic trading and 50 days afterwards were examined. Similar results to the Frino et al (1998) study were found that electronic trading reduced the BASs across the three exchanges, but may increase spreads when price volatility is higher.

2.3 Measures of performance

2.3.1 Return

Reilly and Brown (1997) defines an investment as the current commitment of money for a period of time to derive future return payments that will compensate the investor for the time the funds are committed, the expected rate of inflation and the uncertainty of the future payments. This means that the investor is trading a known amount of money today for some expected future stream of payments that will be greater than the current amounts he holds. The investor therefore requires an amount of return that compensates him so that he can defer his current consumption for future streams of payments. This rate of return can also be called the investors required rate of return. Therefore the return on investment can be defined as the change in wealth resulting from the investment

Jansen (1968) reports that the concept of the portfolio 'performance' has at least two distinct dimensions. The ability of the manager or the security analyst to increase returns on portfolio through successful prediction of future security prices and the ability of the portfolio manager to minimize (through efficient diversification) the amount of 'insurable risk' faced by the holders of the portfolio.

Markowitz (1952) propounded that investors will seek to either maximize expected returns subject to a given level of risk or minimize risk given a certain level of expected returns. There is always a trade off between risk and return. Green et al (2003) modeled

return for the purpose of event study as the difference between daily closing stock prices. The model is similar to Mackinley (1997)'s security returns market model.

This research therefore has measured return by applying, $(P_1-P_0)/P_0$, model where P_0 and P_1 are the stock prices at day 0 and 1 respectively.

2.3.2 Trading volume

Volumes refer to trading levels. The observed trading volume levels reactions reinforce the findings on abnormal returns. However the problem of volumes is that they lack support of economic theory. Both Beaver (1968) and Verrecchia (1981) recognize that the volume measure of information is ad hoc only. An accurate and consistent measure of trading volume is important to market participants. For example, institutional investors and other investors with large shareholding, frequently assess the liquidity for their investments in a particular common stock in terms of the number of days of normal trading volume represented by their holding or a similar volume-related measure. They further report volume affects market liquidity, for instance, it is easier to liquidate a position equal to one half day's trading volume without disrupting the market than it is to sell a holding comprising two days trading volume.

Clearly the problem arise in assessing the liquidity of a large investment in a stock if the trading volume reported by stock exchange is not an accurate measure of actual trading volume of the stock. However Hansch, et al (1998) reported that trading volume can be overstated due to interdealer trading. For example, when a dealer acquires additional inventory from other dealers to fill a large order from a public investor, each of these inter-dealer trades is reported as trading volumes even though no shares were bought yet by an investor. Anderson and Dyl (2003), used average daily volume to measure market structure in New York Stock Exchange and Nasdaq.

This research has used average daily volume to arrive at abnormal volumes and liquidity.

2.3.3 Market Liquidity

In a liquid financial market, investors are able to sell large blocks of assets without substantially changing the price. Choi and Cook (2005) found that liquidity of major markets substantially varies over time and that the unpredictability of the same is an important source of risk to investors. They reported that impact of stock trading on share prices rose substantially after the collapse of the bubble.

Electronic trading can contribute to market liquidity through its impact on fairness, speed of execution, access and costs (Harris, 2003). Electronic trading enhances fairness and execution speed because the matching and trading rules are implemented objectively and transparently by the system. Manual floor trading may be subject to variations in the interpretation of rules, and outright cheating. Electronic trading also removes the physical constraints to which floor trading is subject and gives equal access to all traders (Allens et al, 2001).

There are three ways to measure liquidity. One is by Pastor and Stambaugh(2002) while another one is suggested by Amihud (2002). The third one is turnover ratio. These three measures have the advantage of being constructed from daily returns and volumes data which are readily available at NSE.

Pastor and Stambough (2002) suggest measuring liquidity by the coefficient Y in the following regression $R_{i,d+1,t} = Q_{i,t} + O_{i,t}\, r_{i,d,t} + Y_{i,t\,Sign}(R_{i,d,t}).\, V_{i,d,t} + \sum_{i,d+1,t}$ Where $r_{i,d,t}$ and $R_{i,d,t}$ are the simple and excess return on stock *i* on day *d* on month *t* respectively and $V_{i,d,t}$ is the dollar volume for stock *I* on day *d* on month *t*. The liquidity measure is the coefficient on the lagged volume and intuitively captures the subsequent days correction to an order of flow shock. The method is motivated by Campbell et al (1993) model which shows volume related return reversals arising from liquidity effects. The idea is that if a stock is not perfectly liquid, an order flow shock should be accompanied by a return that partially reverses in the future. Hence Y should be negative, and the more negative it is, the lower the liquidity.

Amihud (2002) on the other hand suggests measuring illiquidity of stock *i* in month *t* as:

$$ILLIQ_{i,t} = 1/Days_{i,t} \sum R_{i,d,t} / V_{i,d,t}$$

Where $R_{i,d,t}$ and $V_{i,d,t}$ are, respectively, the return and volume on stock *i* on day *d* on month *t*. It is based on intuition that for an illiquid stock, the price moves by a lot in response to little volume.

The turnover ratio is another alternative measure of liquidity. Turnover rate is defined as the number of shares traded as a fraction of shares outstanding. Ozoguz (2003) found that Amihud (2002) illiquidity model and turnover ratio measures of liquidity have similar results. This study has measured liquidity by applying turnover ratio.

3. RESEARCH METHODLOGY

3.1 The population

The population consisted of 51 companies listed in the NSE at the time of introduction of automated trading system, on 11 September, 2004.

3.2 The sample

To obtain a convenience sample, the population stated above was narrowed down to exclude the factors that can cause confounding effects similar to Cheung and Sami (2000). This required companies with a few trading days within the test period, which included Limuru Tea Co and Kenya Orchard Ltd to be excluded. This Kibuthu (2005) noted this will eliminate confounding effects. Companies that were suspended included Hutching Biemer, Uchumi Supermarkets, BOC and Carbacid Investments were also excluded.

East Africa Cables was the only company whose stock prices overreacted, that is, had an absolute daily return of more than 10% according to NSE trading rules, within the test period, (www.nse.co.ke). The same company had a stock split and was therefore not sampled. Other companies eliminated were Scangroup, Kengen and Equity bank which joined the market during the test period.

3.3 Data collection methods

Secondary data has been used in this research. The data comprising of stock prices, trading levels and ATS introduction date was obtained from NSE information department. A 120 days estimation window and 31 days event window has been used. Cheung and Sami (2000) used a similar study method while examining the relations between annual earnings announcements and market reaction in Hong Kong Stock Exchange.

They used daily trading volumes and returns to determine abnormal return and trading levels. MacKinlay (1997) indicated the diversity of application of event study in both

firm specific and economy wide events. The usefulness of events study comes from the fact that the effects of an event will be reflected immediately in security prices.

Each test periods cover the observation window of 31 trading days between the day -15 to the day +15, while day 0 is the date of ATS introduction. Based on the daily returns and daily trading volume data in the observation window, the return residuals and volume residuals were estimated. Campbell et al (1993) reported substantial departures from normality in the abnormal returns of Nasdaq stocks. For the purpose of further controlling the market wide effects, the study has used a shorter estimation and observation windows (Mackinly, 1997). Cheung and Sami (2000) used 120 trading days and 31 trading days for estimation and observation windows respectively.

3.4 Data analysis techniques

Daily data on stock prices and trading levels have been collected and computed into returns and volumes. The data has been analyzed vide the following models as used by Cheung and Sami (2000) and Green et al (2003). For empirical purposes the returns and trading volumes has been transformed into residuals through the following equations:

$Rit=ai+biRmt+uit$ (Normal Return model)

$Vit = ci+diVmt+vit$ (Normal model for volume)

Turnover ratio = daily volume/outstanding no. of shares (Liquidity model)

Where:

Rit = Daily return of stock i

Rmt = Daily value-weighted market returns with cash dividends reinvested (NSE index)

Vit = Daily shares of stock i traded/shares of stock i outstanding

Vmt = Daily shares traded on NSE20/NSE20 shares outstanding

uit = Return residual for stock i at time t

vit = Volume residual for stock i at time t

a, b, c, and d = Regression coefficients and constants determined by simple regression using daily data for up to 120 days before the 31 days test period.

Using the above models, the residues have been estimated for each of 31 days observation window (test period). These residuals have been transformed through division by company specific estimated standard deviations of the market model residuals (as a deflator) over the estimation period to help attain some distributional comparability across firms. The test of significance was done at 5% level as tested by Green et al (2003) and Cheung and Sami, (2000).

4.0 FINDINGS AND INTERPRETATION

4.1 Introduction

The aim of this study was to assess the improvement in functioning of the Nairobi Stock Exchange following the implementation of new technology and automation of the trading system. The market had previously been operating on floor based trading system until 11 September, 2006, when it was automated. The study used historical market data. Return and volume residues and turnover ratios were calculated within the event window period of 31 days. The analysis was done by comparing the mean residues and turnover ratio before and after introduction of ATS. The market was separated between Main Investments Market Segments (MIMS) and Alternative Investments Market Segments (AIMS).

The regression coefficients are tabulated in appendix 7.1. Security return residues are given in appendix 7.2 within the event window. Volume residues are shown in Appendix 7.3, liquidity turnover ratios are indicated in appendix 7.4 while appendix 7.5 details the results of the analysis in terms of mean and standard deviations, within the event window.

4.2 Abnormal returns

In MIMS there was a marginal improvement. The standardized cumulative mean return residues improved from 5.7852 to 5.91931 following automation. The absolute mean residues have also improved marginally. The risk on the same has increased marginally as measured by standard deviation and tabulated in Table 4.1. This seems consistent with Harry Markowitz risk-return trade off, (Markowitz, 1952). Table 4.2 shows that AIMS standardized mean return residues have increased from -0.796 to -2.846. The mean absolute return indicate improvement, with corresponding standard deviation indicating increased risk. The results indicate that the change was not statistically significant.

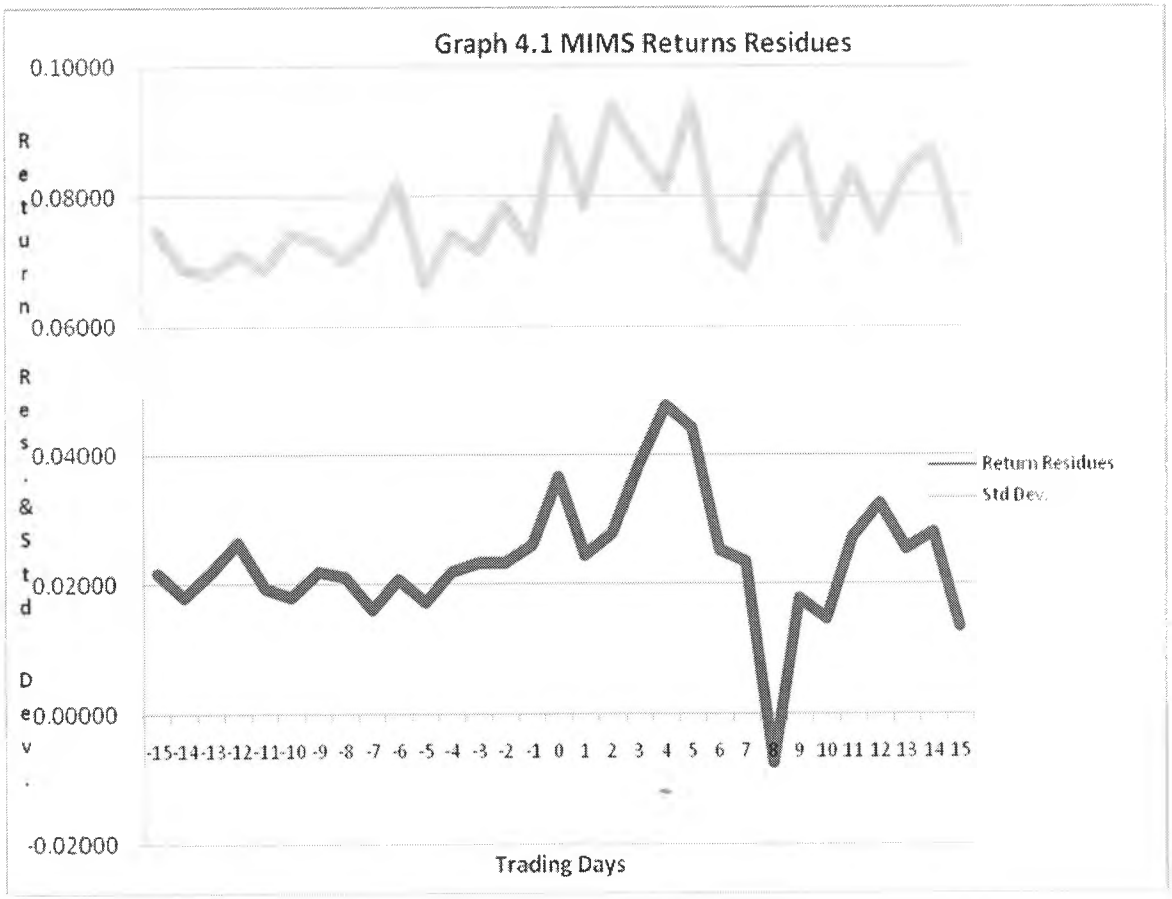
Table 4.1 The mean and standard deviation of the abnormal returns and volumes, and liquidity in MIMS

	MIMS							
	Abn.Returns				Abn. Volumes		Liquidity	
	Cum.Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pre- ATS	5.78520	4.40061	0.02100	0.06971	0.00114	0.00326	0.00129	0.00322
Post- ATS	5.91931	4.08612	0.02540	0.07291	0.00139	0.00289	0.00153	0.00286
Change	0.13411	2.10213	0.00440	0.00919	0.00024	0.00065	0.00024	0.00065
(POST-PRE)								
Test of Signf								
t	0.0637972		0.478637		0.374397		0.374437	
Critical values at 5%	2.179		2.179		2.179		2.179	

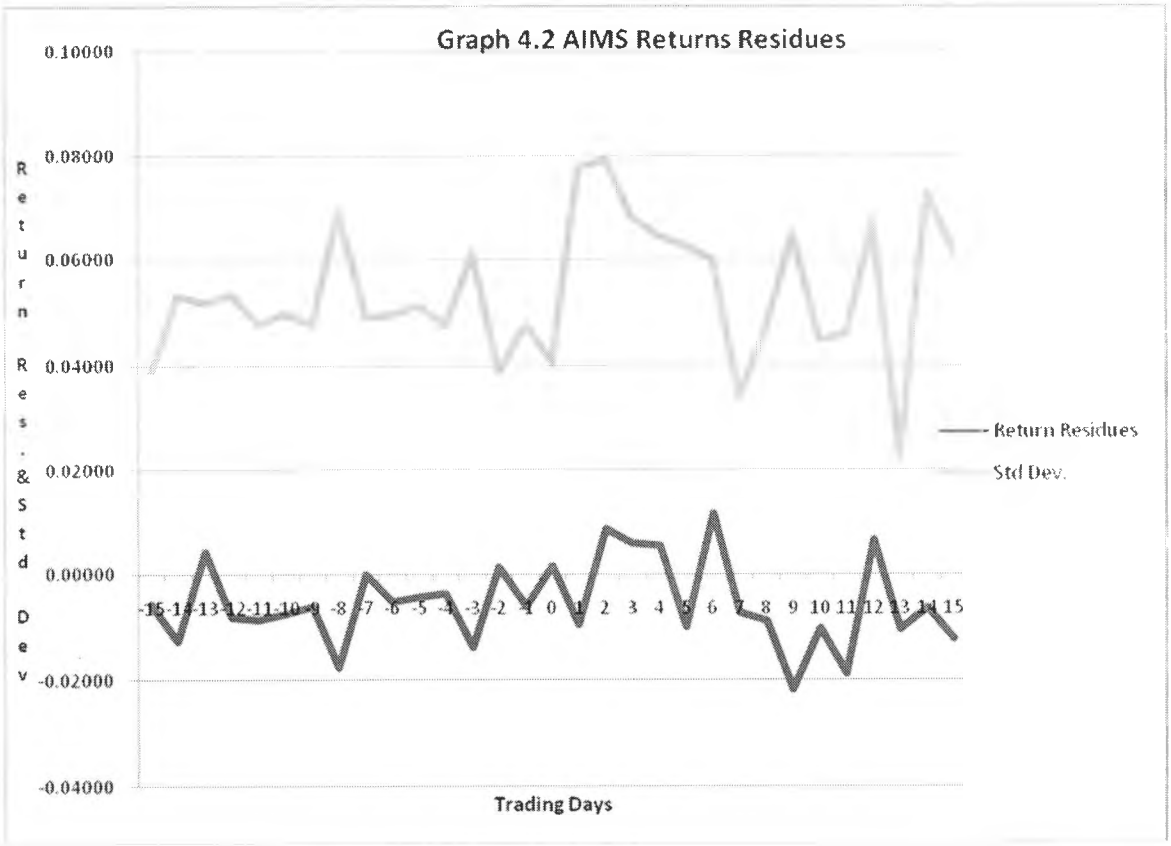
Table 4.2 The mean and standard deviation of the abnormal returns and volumes, and liquidity in AIMS

	AIMS							
	Abn. Returns				Abn. Volumes		Liquidity	
	Cum.Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pre- ATS	-0.79600	1.01289	-0.00622	0.04904	0.00058	0.00144	0.00029	0.00044
Post- ATS	-2.84600	1.59019	-0.00512	0.05509	0.00078	0.00141	0.00049	0.00070
Change	-2.05000	1.14260	0.00110	0.00663	0.00020	0.00031	0.00020	0.00031
(POST-PRE)								
Test of Signf								
t	-1.794154		0.165719		0.643862		0.643862	
Critical values at 5%	2.179		2.179		2.179		2.179	

Graphs 4.1 and 4.2, below, indicate improvement of return residues following automation with accompanying increase in riskiness. This could have been caused by uncertainty of the new system. Indeed the system failed the first day and the management increased the official trading time. Another possibility would be that before implementation of ATS the market was undervaluing the securities, and due to increased transparency after automation, the market then started correcting.



Graph 4.2 indicate the return residues of alternative market segment are averagely negative. The market segment however seems unstable after automation. The cause could be the investors' uncertainity about the security of the system.



4.3 Abnormal volumes

In both MIMS and AIMS there was marginal improvement. The MIMS mean volume residues improved from 0.00114 to 0.00139 following automation. The risk on the same has increased from standard deviations of 0.00326 to 0.00289, as per Table 4.1 on page 23. Table 4.2 on page 23, shows that AIMS mean volume residues have also increased from 0.00058 to 0.00078 with corresponding standard deviation having the same behavior. These findings are consistent with Cheung and Sami (2000) who found positive changes on volume residuals in their 31 days event window. However, the t-test on tables 4.1 and 4.2 on page 23, shows the findings are not statistically significant.

4.4 Liquidity (turnover ratio)

Liquidity was measured by use of turnover ratio. Surprisingly the liquidity and volume residues have the same results after comparing post and pre-automation performance. In both MIMS and AIMS there was marginal improvement. The MIMS mean turnover ratios improved from 0.00129 to 0.00153 following automation. The risk on the same has increased as per table 4.1 on page 23. Table 4.2 on page 23 shows that AIMS mean volume residues have also increased from 0.00029 to 0.00049 with corresponding standard deviation having similar trend of results. This is in consistent with findings of Green et al (2003). Green et al found improved trading after automation of Mumbai Stock Exchange but the changes were not statistically significant.

4.5 Test of significance

The research had Null hypothesis as M1 (Post-Automation mean) – M2 (Pre-Automation mean) = 0, while Alternative hypothesis was M1-M2≠ 0. At 95% confidence level the research accepts the null hypothesis and rejects the alternative hypothesis. The results of the t tests are shown in the tables 4.1 and 4.2 on page 23. All the three proxies of performance in this research, namely abnormal return, abnormal volume and turnover ratio have been tested individually, both in MIMS and AIMS. Although marginal improvement was recorded in performance after automation, the results were statistically insignificant. These findings are similar to conclusions of Green et al (2003).

5.0 CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

5.1 Conclusions

From the findings of this research it can be concluded that Nairobi Stock Exchange experience marginal improvement in terms of returns, volumes and liquidity. However the risk increased following automation. These findings were common to both MIMS and AIMS market segments. The performance as measured by returns, volume and liquidity indicated marginal improvement following automation. The risk increased marginally within 15 days after automation. These changes were however not significant.

In conclusion therefore it can be said that introduction of ATS has no significant effect on performance of Nairobi Stock Exchange within the short term. This is consistent with Chang et al (1999) who found no change in liquidity and in the efficiency of the price discovery process after automation of Taiwan Stock Exchange. The failure by NSE automation to address the interest of the investors immediately, raises concern as to the benefits of microstructure reforms within the short term.

5.2 Limitations of the study

This study uses shorter estimation and event window which could lead to confounding effect especially with a narrow sample as provided by NSE. Some securities in the NSE data had not recorded trades in some days within the test period. The research modeled the data to ensure in such instances the previous prices were recorded to give nil returns. This may have limited the findings. This type of weakness is common to emerging markets (Majnoni and Massa, 2001).

The result also relied on the mean to analyze residues. The mean has been questioned before as it is affected by extreme values. Therefore the result obtained might be inferior to those observed using different criteria.

The study used event study methodology which factors short term effects. The conclusions can therefore be valid only within the short term.

5.3 Recommendations for further research

This research may be replicated using other models such as sharp ratio after allowing some years of post-automation trading. This way the test period will be longer. A long event window should shed light on the permanency of the effect of automation on stock prices (Amihud et al, 1997).

Another area of future research is to use other market models such as Comparison Period Approach instead of the event window study.

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Appendix 7.1 Regression Co-efficients

Co-efficients	Unilever Tea K	Kakuzi Ord.5.0	Rea Vipingo Pl	Sasini Tea &	Car & Genera	CMC Holdings	Kenya Airway	Marshalls (E.A	Nation Media	TPS Ltd Ord 5	Barclays Bank
a	-0.02023	-0.06934	0.03481	-0.06435	-0.10675	-0.05695	0.07549	-0.08766	-0.00335	0.07092	-0.03079
b	0.00000	0.00002	-0.00001	0.00002	0.00003	0.00001	-0.00002	0.00002	0.00000	-0.00002	0.00001
c	6.77991E-06	-0.00017697	-0.00028989	0.0003162	2.76812E-05	0.001254596	0.000287039	8.23016E-05	-0.00035783	0.00010982	0.000149354
d	0.019481912	1.413578162	2.741272594	0.5544619	0.233992695	4.526375788	1.408268799	0.254607788	1.81603658	0.04223281	0.037595535
Co-efficients	C.F.C Bank Ltd	Diamond Trust	Housing Financ	I.C.D.C Inve	Jubilee Holdin	Kenya Comme	National Bank	NIC Bank Ltd (	Pan Africa Ins	Standard Chartered	
a	-0.02373	-0.05776	0.06249	-0.07461	0.01919	0.01919	0.00696	-0.18110	-0.22327	-0.01554	
b	0.00001	0.00001	-0.00001	0.00002	0.00000	0.00000	0.00000	0.00004	0.00006	0.00000	
c	2.59641E-05	-6.16778E-06	0.001602041	-0.000297	9.45031E-05	0.000345287	7.53962E-05	-0.0001453	0.00026989	7.8145E-05	
d	0.138877259	1.6290954	0.097872422	3.3430317	0.046526459	1.433248212	1.825873482	1.562334546	-0.1062385	0.01499503	
Co-efficients	Athi River Mir	Bamburi Ceme	British America	Crown Berg	E.A.Portland C	East African Bre	Kenya Oil Co L	Kenya Power	Mumias Sugar	Olympia Capital	
a	-0.05195	-0.05769	-0.01057	0.02922	-0.01109	-0.00112	0.01439	-0.07604	0.12717	0.01475	
b	0.00001	0.00001	0.00000	-0.00001	0.00000	0.00000	0.00000	0.00002	-0.00003	0.00000	
c	0.000563072	6.49517E-05	-6.53805E-05	0.0007908	3.0634E-05	-4.76973E-06	-0.00013347	-0.00034976	0.00049363	-3.9544E-06	
d	1.150064502	0.00323674	0.777759569	0.0057275	0.254404395	0.524114996	1.030539497	4.204528351	2.8532703	0.26275862	
Co-efficients	Sameer Africa	Total Kenya Ltd	Unga Group Lt	A.Baumann	City Trust Ltd	Eaagads Ltd Or	Express Ltd O	Williamson Te	Kapchorua Te	Standard Gr	
a	0.03912	-0.00026	0.04237	0.00757	-0.00303	-0.00123	0.06388	-0.01586	0.05650	-0.08140	
b	-0.00001	0.00000	-0.00001	0.00000	0.00000	0.00000	-0.00001	0.00000	-0.00001	0.00002	
c	0.000106332	-0.000201584	0.000145566	-0.0038	0.000138411	1.34341E-05	0.001587305	2.94905E-05	-1.3501E-05	-7.3809E-06	
d	0.989910475	1.589138863	1.915902156	16.932548	0.167335864	-0.009489321	1.719868458	0.423500133	0.07726192	0.3727537	

Appendix 7.2. Return residues for all the sampled companies and NSE share indices within the event window

Days	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
Securities	Return Res	Return Resi	Return Res	Return Resi	Return Res	Return Res	Return Res	Return Res	Return Res	Return Res	Return Resi	Return Resi	Return Re	Return Res	Return Res	Return Res
Unilever	-0.00137	-0.04080	-0.00137	-0.00147	-0.00138	-0.00729	0.02811	-0.00156	-0.01296	-0.00148	-0.02470	-0.00151	-0.00157	-0.00157	-0.00164	-0.04956
Kakuzi Or	0.06934	0.06934	0.06934	0.06934	0.06934	0.04806	0.06934	0.06934	0.08383	0.06934	0.06934	0.06934	0.06934	0.02648	0.06934	0.12904
Rea Vipir	-0.02290	0.00049	-0.01208	-0.03481	-0.02370	-0.04580	-0.03481	-0.03481	-0.02370	-0.04580	-0.03481	-0.03481	-0.01259	-0.05655	0.02075	-0.02428
Sasini Te	0.06435	0.06435	0.07275	0.10601	0.03235	0.08087	0.06435	0.06435	0.06435	0.08874	0.06435	0.10403	0.11778	0.12956	0.11197	0.12279
Car & Ge	0.10675	0.10675	0.14325	0.10675	0.09267	0.10675	0.10675	0.09961	0.10675	0.10675	0.10675	0.10675	0.10675	0.10675	0.10675	0.10675
CMC Hol	0.02886	0.06273	0.07419	0.03435	0.06273	0.06845	0.06832	0.05133	0.05695	0.05695	0.06260	0.06819	0.06251	0.15087	0.06200	0.09213
Kenya Air	-0.07549	-0.08418	-0.06671	-0.07549	-0.08418	-0.07549	-0.08426	-0.06664	-0.08426	-0.08434	-0.07549	-0.07549	-0.06656	-0.06664	-0.07549	-0.06671
Marshall	0.08766	0.08766	0.08766	0.08766	0.04186	0.08766	0.08766	0.08766	0.08766	0.11166	0.08766	0.08766	0.08766	0.08766	0.08766	0.08766
Nation M	0.00833	0.00830	-0.00157	0.00335	0.00335	0.01325	-0.00155	0.00335	0.00828	0.00335	-0.00645	0.00335	0.00830	-0.00157	0.02810	0.00818
TPS Ltd C	-0.08082	-0.07092	-0.07092	-0.07092	-0.07092	-0.07092	-0.07092	-0.07092	-0.07092	-0.07092	-0.07092	-0.07092	-0.10092	-0.08123	-0.10738	0.01016
Barclays	0.03079	0.03419	0.05791	0.03409	0.03079	0.03079	0.03079	0.03408	0.03079	0.03079	0.01767	0.03079	0.03079	0.04075	0.03079	0.03737
C.F.C Bar	0.01763	0.00532	0.02998	0.11689	0.01805	0.00087	-0.04060	0.02373	0.02373	0.02373	0.02373	0.02373	0.02373	0.04248	0.00532	0.12373
Diamond	0.05046	0.01365	0.09622	0.05776	0.05776	0.02813	0.05776	0.05013	0.07315	0.04261	0.08084	0.07280	0.05776	0.05776	0.06517	0.07247
Housing	-0.07468	-0.09335	-0.08160	-0.06249	-0.03651	-0.10046	-0.00986	-0.01874	-0.11638	-0.07514	-0.08172	-0.04288	-0.07531	-0.03002	-0.04362	-0.03780
I.C.D.C In	0.13668	0.08760	0.06179	0.08111	0.08752	0.06188	0.11332	0.08083	0.10548	0.06863	0.08064	0.08659	0.08053	0.12756	0.08020	0.09684
Jubilee H	-0.00692	-0.00101	-0.06681	-0.01919	-0.03169	-0.02552	-0.01919	-0.02556	-0.01278	-0.02556	0.00645	-0.01919	0.00581	-0.01919	-0.04358	-0.01294
Kenya Co	-0.06464	-0.01919	-0.01324	0.00448	-0.01341	-0.01344	-0.01347	-0.01919	-0.01351	-0.02484	-0.01351	-0.01919	-0.01354	-0.00795	-0.01919	-0.01919
National	-0.00696	-0.02726	-0.02250	0.00357	0.00867	-0.03260	-0.00169	0.00352	0.00341	-0.01208	-0.00180	-0.01208	0.00851	-0.00188	-0.00190	0.04832
NIC Bank	0.17589	0.17587	0.17584	0.15994	0.17029	0.17564	0.19759	0.14867	0.15317	0.20409	0.16987	0.19815	0.18110	0.19228	0.18663	0.24154
Pan Afric	0.21151	0.21137	0.12689	0.22327	0.22327	0.22327	0.22327	0.22327	0.22327	0.29661	0.15495	0.22327	0.22327	0.22327	0.22327	0.30327
Standard	0.00913	0.02199	0.00913	0.02199	0.00913	0.01554	0.02844	0.00917	0.01554	0.03477	-0.00333	0.02195	0.02190	0.00921	0.02190	0.01554
Athi Rive	-0.04864	0.03222	0.07209	0.09800	0.13371	0.06939	0.05195	0.04052	0.04617	0.04032	0.05195	0.07548	0.05770	0.05767	0.06332	0.06319
Bamburi	0.08208	0.05174	0.07566	0.05769	0.05181	0.06361	0.05769	0.12828	0.01374	0.06344	0.07484	0.05769	0.06893	0.04658	0.05769	0.12511
British Ar	0.01057	0.00016	0.03162	0.01057	0.01057	0.01057	0.01057	-0.00489	0.02628	-0.01520	0.01057	0.01057	0.01586	0.00531	0.01057	-0.00530
Crown Be	-0.00732	-0.04350	-0.01472	-0.02922	-0.05064	-0.01462	-0.02922	-0.02922	-0.02922	-0.02922	-0.00044	-0.04320	-0.02922	-0.06468	-0.01451	-0.02197
E.A.Portl	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.08032
East Afric	-0.00613	0.00842	0.00112	0.03010	0.00816	0.02210	0.00112	-0.00573	-0.00578	0.00112	-0.00583	-0.01986	0.00826	0.00112	0.00112	-0.00598
Kenya Oi	0.00270	-0.01439	-0.00599	-0.01439	-0.01439	-0.02273	-0.01439	-0.01439	-0.01439	-0.01439	-0.04801	-0.01439	-0.01439	-0.04048	0.03918	-0.03134
Kenya Po	0.16893	0.08604	0.06119	0.05594	0.04527	0.12366	0.08614	0.09104	0.07604	0.07604	0.07604	0.07604	0.07604	0.07604	0.08096	0.07604
Mumias S	-0.10015	-0.09208	-0.12717	-0.13565	-0.11008	-0.13558	-0.12717	-0.13565	-0.12717	-0.13572	-0.11855	-0.11863	-0.11022	-0.11884	-0.12717	-0.16849
Olympia	-0.01475	-0.01475	-0.01475	-0.01475	-0.01475	0.00565	-0.01475	-0.01475	-0.01475	-0.01475	0.01858	-0.01475	-0.01475	-0.01475	-0.01475	-0.06637
Sameer A	-0.03241	-0.05579	-0.05607	-0.00464	-0.02912	-0.04572	-0.03912	0.00075	-0.08065	-0.03912	-0.04245	-0.03578	-0.03912	-0.03912	-0.02912	-0.04572
Total Ker	0.00692	0.00688	-0.01290	0.00026	0.00692	-0.00637	0.00026	0.01359	-0.00632	0.00026	0.00688	0.00683	-0.01935	-0.00641	-0.01317	0.00026
Unga Gro	-0.00044	0.01645	0.05412	-0.01571	-0.04237	-0.04497	-0.05279	-0.07658	-0.05600	-0.04237	-0.06447	-0.07345	-0.03654	-0.05397	0.00748	-0.04517
A.Bauma	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757
City Trus	0.00303	0.00303	0.02867	-0.01364	0.00303	0.00303	0.00303	0.00303	0.02846	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303
Eaagads	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123
Express L	-0.04388	-0.07368	-0.06388	-0.07378	-0.06388	-0.07388	-0.06388	-0.14469	-0.05289	-0.06388	-0.06388	-0.05301	-0.11764	-0.00706	-0.06388	-0.01012
Williams	0.00033	-0.04253	0.05802	0.00026	-0.01786	0.00030	0.00025	0.00019	0.00026	0.00025	0.00028	0.00023	0.00019	0.00019	0.00013	-0.00008
Kapchoru	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650
Standard	0.06376	0.08739	0.06950	0.09345	0.08140	0.08140	0.08140	0.08140	0.08736	0.08732	0.09317	0.08722	0.08140	0.07562	0.08140	0.08140
NSE 20-SH	4467.40	4442.50	4467.36	4488.56	4469.60	4476.07	4489.60	4507.15	4486.07	4490.84	4481.70	4496.47	4507.99	4508.02	4523.80	4585.94

Appendix 7.2(Continuation)

Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Securities	Return Resid	Return Resi	Return Res	Return Res	Return Resi	Return Res	Return Res	Return Res	Return Resi	Return Res	Return Res	Return Resi	Return Re	Return Res	Return Residues
Unilever	0.02298	-0.00223	-0.03901	0.00992	-0.01567	0.00933	0.00290	-0.03389	-0.00287	0.01660	0.00340	-0.00312	0.00288	-0.00337	-0.00940
Kakuzi Or	0.01300	0.11411	0.07648	0.08352	0.16025	0.09498	0.06309	0.02531	0.06934	0.03644	0.11696	0.07583	0.15321	0.06934	0.02767
Rea Vipir	-0.04522	-0.06639	-0.03481	-0.03481	-0.01307	0.02902	0.05519	-0.03481	-0.08068	-0.04442	-0.04452	0.00441	-0.12915	0.02769	0.01421
Sasini Tea	0.08275	0.14868	0.15323	0.09496	0.14355	-0.00905	0.08415	0.00124	0.02290	-0.01674	0.10552	0.09259	0.14676	0.13034	0.03577
Car & Ge	0.10675	0.11395	0.10675	0.14247	0.18262	0.06829	0.10675	0.10675	0.17342	0.03175	0.10675	0.18783	0.15675	0.18413	0.13438
CMC Hol	0.10550	0.04769	0.13172	0.14391	0.13695	-0.00231	0.06483	0.05695	-0.01336	0.09897	0.06502	0.05695	0.04895	0.01663	0.05695
Kenya Air	-0.04940	-0.05006	-0.08375	-0.04215	-0.05936	-0.01199	0.01407	-0.15768	-0.12026	-0.10674	-0.06742	-0.01149	-0.09052	-0.07549	-0.07549
Marshall	0.10329	0.08766	0.12612	0.14692	0.09465	0.08766	0.11544	0.18225	0.13087	0.14683	0.04855	0.08766	0.08766	0.08766	0.08766
Nation M	0.00335	0.00335	0.00335	0.01297	-0.02522	0.05237	0.03139	-0.00574	-0.00582	0.04039	0.02567	0.00772	0.02074	0.00763	-0.06048
TPS Ltd C	-0.08592	-0.15214	-0.09302	-0.09917	-0.08255	-0.04739	-0.07667	-0.08826	-0.06504	-0.07677	-0.06504	-0.02414	-0.11561	-0.07677	-0.01210
Barclays	0.04059	0.09228	-0.00885	0.03714	0.04025	0.06204	0.05503	0.02191	0.00691	-0.00591	0.05936	0.03079	0.04005	0.06443	-0.00471
C.F.C Bar	-0.00468	0.04127	0.02373	0.01223	0.05280	0.03503	0.01814	0.02373	-0.02122	0.07667	0.01814	-0.00998	0.02954	0.04685	-0.01582
Diamond	0.07950	0.09322	0.09201	0.07763	0.10322	0.04534	0.05776	0.01374	0.08408	-0.02557	0.07874	0.05776	0.09886	0.09724	0.05143
Housing	-0.03839	-0.04484	0.03578	0.02172	0.02489	0.02680	-0.00511	-0.11675	-0.16085	-0.11703	-0.09133	0.01672	0.00173	-0.10559	-0.07150
I.C.D.C In	0.16701	0.16417	0.17051	0.17461	0.16931	-0.01535	0.00617	0.04196	0.08305	0.07461	0.09554	0.14839	0.10133	0.17127	0.11529
Jubilee H	-0.01298	-0.02536	-0.00677	0.01149	-0.06085	0.08019	0.03166	-0.00843	-0.01919	-0.08302	0.00354	-0.01919	-0.06919	0.03344	0.03637
Kenya Co	-0.01919	-0.01919	-0.00252	0.01906	0.03344	0.00081	-0.02899	-0.07364	-0.01919	-0.00348	-0.03981	-0.00866	-0.02960	-0.00340	0.00154
National	0.00257	0.04021	0.08313	0.09222	0.03816	0.07218	-0.10696	-0.10325	-0.09712	0.01106	0.08154	0.06622	0.02335	-0.01431	-0.04399
NIC Bank	0.18628	0.18110	0.21203	0.18110	0.17110	0.18110	0.18110	0.13565	0.23401	0.15095	0.17592	0.19673	0.14521	0.23429	0.18615
Pan Afric	0.24179	0.26570	0.22327	0.26397	0.29590	0.22327	0.21806	0.20757	0.22327	0.20200	0.25588	0.20222	0.20714	0.22327	0.14131
Standard	0.02819	0.02179	0.00932	0.04054	0.02773	0.10590	-0.02866	0.00397	-0.00201	0.02744	-0.00799	0.02156	0.01554	0.01554	0.02152
Athi Rive	0.00751	0.10428	0.09063	0.05195	0.05195	0.03599	0.00871	-0.00455	0.09387	0.02322	0.04012	0.07590	0.07534	0.10338	0.02478
Bamburi	0.05769	0.06822	0.06290	0.05251	0.08373	0.06277	0.03244	0.04215	0.07348	0.05251	0.04728	0.04190	0.07374	0.02611	-0.00209
British Ar	0.01057	0.00520	0.01057	0.00517	0.03231	0.01057	0.02121	0.01057	0.00005	0.02121	0.01584	0.02628	0.01573	0.03108	-0.00953
Crown Be	-0.00044	-0.02222	-0.07088	-0.01472	-0.02207	-0.02922	-0.00794	-0.08477	-0.02922	0.00020	0.01364	-0.01552	0.01132	-0.06818	-0.02922
E.A.Portl	-0.01769	-0.02595	0.07263	0.03283	0.03946	0.01109	-0.01650	-0.06692	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109	0.01109
East Afric	0.00826	0.00112	0.00112	0.00112	0.00112	0.00112	0.00112	0.01530	0.01510	-0.01957	0.01520	0.00806	0.00801	0.00797	0.02152
Kenya Oi	-0.02301	-0.01439	-0.01439	-0.01439	-0.01439	-0.01439	0.01169	-0.02287	-0.03149	-0.01439	-0.01439	-0.09266	-0.06156	0.00541	-0.04352
Kenya Po	0.10545	0.09985	0.17371	0.17350	0.16484	0.06540	0.05095	-0.00484	0.06804	0.07604	0.16878	0.10187	0.06525	-0.11669	0.17063
Mumias S	-0.13579	-0.20543	-0.08000	-0.10915	-0.13602	-0.14503	-0.12717	-0.14535	-0.13643	-0.13652	-0.17434	-0.10737	-0.11746	-0.06948	-0.12717
Olympia	-0.06237	-0.01118	-0.03255	0.03597	0.01973	-0.01475	-0.01475	-0.08142	0.02810	0.06744	-0.06539	-0.00475	-0.02135	-0.04133	-0.01475
Sameer A	-0.02915	-0.03912	-0.04241	-0.01272	-0.01661	-0.09572	-0.03912	0.00755	0.04050	-0.00667	-0.04769	-0.08235	0.03618	-0.03352	-0.09205
Total Ker	0.00706	-0.02677	0.01414	0.01395	-0.00650	-0.02015	0.00026	0.00026	0.00720	0.00026	0.02784	-0.01317	0.00026	0.00706	-0.02677
Unga Grc	-0.03117	-0.05068	-0.06193	0.01176	-0.11535	-0.10360	0.01353	-0.11884	0.04043	-0.01296	-0.03952	-0.02813	-0.08170	-0.04530	-0.04531
A.Bauma	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757	-0.00757
City Trust	-0.00523	0.01136	-0.00523	0.03636	0.00303	0.05142	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303	0.00303	0.03380	0.00303
Eaagads	0.00123	0.00123	0.00123	0.00123	-0.02434	0.00123	-0.00751	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123	0.00123
Express L	-0.12510	-0.06388	-0.04214	-0.06388	-0.05324	-0.03230	-0.05368	-0.07398	-0.07408	-0.07419	-0.10555	-0.04214	-0.02133	-0.12510	-0.11823
Williams	-0.00631	-0.00029	-0.00043	-0.00066	-0.02581	-0.00108	-0.00746	-0.00072	-0.00075	-0.00058	0.02488	-0.00093	-0.00111	-0.00110	0.01152
Kapchoru	-0.05650	-0.05650	-0.05650	-0.05650	-0.07949	-0.05650	-0.03297	-0.05650	-0.13696	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650	-0.05650
Standard	0.13373	0.17533	0.15211	0.12857	0.11744	0.12488	0.05640	0.07286	0.06416	0.06386	0.00997	0.14871	0.00933	0.11053	0.08140
NSE 20-SI	4601.22	4645.56	4684.57	4750.80	4839.24	4871.76	4876.13	4769.13	4778.35	4728.12	4781.37	4829.04	4881.10	4879.86	4843.23

Appendix 7.3 Volume residues for all the sampled companies within the event window

Days	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
Securitie	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues
Unilever Te	0.00003	0.00001	0.00002	0.00001	0.00001	0.00016	0.00004	0.00002	0.00002	0.00003	0.00003	0.00009	0.00005	0.00001	0.00002	0.00005
Kakuzi Ord	0.00018	0.00018	0.00018	0.00018	0.00018	0.00024	0.00018	0.00018	0.00021	0.00018	0.00018	0.00018	0.00018	0.00053	0.00047	0.00021
Rea Vipinge	0.00206	0.00150	0.00127	0.00272	0.00085	0.00051	0.00078	0.00056	0.00041	0.00040	0.00054	0.00042	0.00039	0.00081	0.00348	0.00186
Sasini Tea &	0.00007	0.00011	0.00013	0.00001	0.00016	0.00000	0.00042	0.00031	0.00007	0.00064	0.00218	0.00098	0.00116	0.02722	0.00105	0.00038
Car & Gene	0.00003	0.00003	0.00053	0.00052	0.00015	0.00015	0.00003	0.00000	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
CMC Holdir	0.00009	0.00526	0.00358	0.00056	0.00103	0.00074	0.00124	0.00121	0.00026	0.00085	0.00071	0.00296	0.00308	0.00022	0.00007	0.00064
Kenya Airw	0.00014	0.00044	0.00064	0.00066	0.00005	0.00002	0.00002	0.00037	0.00008	0.00011	0.00012	0.00101	0.00009	0.00002	0.00029	0.00007
Marshalls (	0.00008	0.00008	0.00008	0.00008	0.00001	0.00008	0.00008	0.00008	0.00008	0.00033	0.00020	0.00007	0.00061	0.00008	0.00008	0.00008
Nation Mec	0.00055	0.00134	0.00091	0.00043	0.00039	0.00038	0.00038	0.00041	0.00052	0.00048	0.00044	0.00055	0.00038	0.00038	0.00039	0.00044
TPS Ltd Ord	0.00008	0.00008	0.00010	0.00005	0.00042	0.00003	0.03390	0.00490	0.01737	0.02077	0.04225	0.07749	0.02804	0.03223	0.01726	0.00590
Barclays Ba	0.00011	0.00005	0.00095	0.00040	0.00017	0.00004	0.00004	0.00020	0.00016	0.00011	0.00004	0.00004	0.00006	0.00022	0.00116	0.00011
C.F.C Bank	0.00002	0.00084	0.00003	0.00002	0.00001	0.00002	0.00010	0.00038	0.00057	0.00000	0.00031	0.00001	0.00071	0.00088	0.00000	0.00002
Diamond T	0.00010	0.00016	0.00097	0.00024	0.00047	0.00008	0.00026	0.00041	0.00006	0.00003	0.00012	0.00111	0.00192	0.00439	0.00197	0.00018
Housing Fir	0.00130	0.00133	0.00122	0.00109	0.00106	0.00119	0.00110	0.00121	0.00055	0.00110	0.00120	0.00084	0.00006	0.00131	0.00106	0.00029
I.C.D.C Inve	0.00707	0.01702	0.00515	0.00370	0.00873	0.00125	0.00330	0.01528	0.00158	0.00247	0.00236	0.00160	0.00221	0.00412	0.00243	0.00310
Jubilee Hol	0.00004	0.00075	0.00009	0.00001	0.00016	0.00007	0.00008	0.00009	0.00008	0.00008	0.00006	0.00024	0.00005	0.00009	0.00003	0.00001
Kenya Com	0.00003	0.00009	0.00014	0.00032	0.00043	0.00106	0.00088	0.00101	0.00128	0.00015	0.00034	0.00025	0.00030	0.00067	0.00003	0.00067
National Ba	0.00066	0.00166	0.00088	0.00053	0.00058	0.00026	0.00020	0.00044	0.00088	0.00032	0.00029	0.00005	0.00026	0.00072	0.00058	0.00058
NIC Bank Li	0.00076	0.00021	0.00122	0.00079	0.00022	0.00105	0.00066	0.00031	0.00016	0.00065	0.00078	0.00046	0.00037	0.00048	0.00020	0.00030
Pan Africa I	0.00026	0.00012	0.00514	0.00084	0.00598	0.00027	0.00017	0.00027	0.00020	0.00024	0.00012	0.00027	0.00027	0.00024	0.00025	0.00025
Standard C	0.00002	0.00004	0.00004	0.00002	0.00009	0.00004	0.00004	0.00137	0.00073	0.00023	0.00003	0.00067	0.00086	0.00006	0.00003	0.00021
Athi River M	0.00023	0.00334	0.00020	0.00048	0.00078	0.00092	0.00072	0.00073	0.00004	0.00054	0.00050	0.00011	0.00039	0.00024	0.00051	0.00030
Bamburi Ce	0.00006	0.00003	0.00006	0.00035	0.00002	0.00006	0.00006	0.00006	0.00006	0.00006	0.00006	0.00005	0.00042	0.00022	0.00006	0.00005
British Amc	0.00007	0.00015	0.00268	0.00059	0.00008	0.00008	0.00007	0.00011	0.00119	0.00009	0.00008	0.00009	0.00018	0.00020	0.00020	0.00018
Crown Berg	0.00055	0.00020	0.00077	0.00079	0.00013	0.00064	0.00079	0.00079	0.00079	0.00079	0.00074	0.00067	0.00079	0.00034	0.00022	0.00031
E.A.Portlan	0.00009	0.00003	0.00000	0.00003	0.00030	0.00003	0.00003	0.00003	0.00002	0.00003	0.00003	0.00003	0.00003	0.00003	0.00000	0.00001
East African	0.00021	0.00009	0.00012	0.00005	0.00002	0.00059	0.00034	0.00093	0.00015	0.00003	0.00003	0.00002	0.00020	0.00024	0.00044	0.00005
Kenya Oil C	0.00015	0.00015	0.00016	0.00016	0.00013	0.00018	0.00013	0.00013	0.00015	0.00013	0.00017	0.00013	0.00013	0.00023	0.00013	0.00023
Kenya Pow	0.01574	0.01019	0.00525	0.00073	0.00083	0.00415	0.00161	0.00383	0.00352	0.00368	0.00186	0.00390	0.00237	0.00311	0.00572	0.00147
Mumias Su	0.00004	0.00171	0.00032	0.00064	0.00103	0.00010	0.00039	0.00090	0.00036	0.00055	0.00007	0.00006	0.00053	0.00068	0.00060	0.00021
Olympia Ca	0.00000	0.00000	0.00000	0.00000	0.00000	0.00005	0.00000	0.00000	0.00000	0.00000	0.00011	0.00000	0.00000	0.00000	0.00000	0.00031
Sameer Afr	0.00057	0.00005	0.00041	0.00020	0.00008	0.00013	0.00008	0.00004	0.00010	0.00015	0.00024	0.00004	0.00050	0.00028	0.00003	0.00047
Total Keny	0.00118	0.00290	0.00117	0.00043	0.00033	0.00063	0.00031	0.00025	0.00274	0.00044	0.00031	0.00022	0.00036	0.00078	0.00166	0.00035
Unga Grou	0.00063	0.00018	0.00106	0.00205	0.00049	0.00228	0.00051	0.00113	0.00096	0.00007	0.00001	0.00063	0.00008	0.00013	0.00167	0.00010
A.Baumann	0.00380	0.00380	0.00380	0.00380	0.00403	0.00380	0.00380	0.00380	0.00380	0.00380	0.00380	0.00380	0.00380	0.00380	0.00380	0.00380
City Trust L	0.00014	0.00014	0.00065	0.00058	0.00014	0.00014	0.00014	0.00014	0.00091	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014
Eaagads Lt	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Express Ltd	0.00257	0.00450	0.00068	0.00023	0.00060	0.00031	0.00159	0.00133	0.00137	0.00078	0.00122	0.00103	0.00124	0.00111	0.00096	0.00089
Williamson	0.00003	0.00031	0.00095	0.00003	0.00078	0.00088	0.00043	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00203	0.00031
Kapchorua	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Standard G	0.00040	0.00046	0.00010	0.00098	0.00027	0.00036	0.00019	0.00011	0.00008	0.00031	0.00006	0.00002	0.00001	0.00042	0.00002	0.00005

Appendix 7.3 (Continuation)

Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Securitie	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues	Vol Residues
Unilever Te	-0.00001	0.00004	0.00001	-0.00000	-0.00002	-0.00001	-0.00003	-0.00002	-0.00004	-0.00003	-0.00001	0.00002	0.00010	-0.00004	0.00018
Kakuzi Ord	0.00061	0.00022	0.00088	0.00103	0.00046	0.00232	0.00196	0.00063	0.00030	0.00029	0.00050	0.00041	0.00061	0.00039	0.00036
Rea Vipinge	0.00170	0.00255	0.00102	0.00135	0.00321	0.00909	0.00186	0.00364	0.00203	0.00149	0.00139	0.00155	0.00087	0.00157	0.00333
Sasini Tea &	0.00093	0.00129	0.00097	0.00068	0.00522	0.00098	0.00350	0.00077	0.01640	0.00161	0.00128	0.00070	0.00309	0.00171	0.00218
Car & Gene	-0.00003	0.00002	-0.00003	0.00056	0.00264	0.00177	-0.00003	-0.00003	-0.00001	0.00022	-0.00003	0.00106	0.00054	0.00066	0.00105
CMC Holdir	0.00121	0.00214	0.00066	0.00069	0.00715	0.00029	0.00126	0.00229	0.00519	0.00479	0.00375	-0.00079	0.00324	-0.00082	-0.00080
Kenya Airw	0.00143	0.00068	-0.00003	0.00069	0.00079	0.00124	0.00225	0.00163	0.00085	0.00007	0.00100	0.00020	0.00037	0.00006	0.00005
Marshalls (	-0.00006	-0.00008	0.00020	-0.00003	-0.00001	-0.00008	-0.00007	-0.00001	0.00006	0.00062	0.00047	0.00000	-0.00008	-0.00008	-0.00008
Nation Mec	0.00042	0.00039	0.00041	0.00040	0.00204	0.00056	0.00110	0.00039	0.00106	0.00090	0.00102	0.00071	0.00055	0.00046	0.00054
TPS Ltd Ord	0.01564	0.01875	0.01690	0.02659	0.01735	0.02051	0.01056	0.01668	0.01719	0.02145	0.00707	0.01767	0.00653	0.01770	0.01010
Barclays Ba	-0.00006	0.00059	-0.00008	-0.00006	-0.00001	-0.00004	0.00016	0.00014	0.00023	-0.00010	0.00074	-0.00001	0.00023	0.00012	-0.00003
C.F.C Bank	0.00000	0.00000	0.00104	0.00025	0.00017	0.00003	0.00017	0.00019	0.00005	0.00096	0.00004	0.00002	0.00005	0.00008	0.00009
Diamond T	0.00131	0.00029	0.00031	0.00053	0.00017	0.00208	0.00109	0.00157	0.00072	0.00070	0.00130	0.00062	0.00073	0.00297	0.00152
Housing Fir	-0.00150	0.00135	-0.00073	-0.00044	-0.00106	-0.00116	-0.00080	-0.00010	0.00066	-0.00123	-0.00075	-0.00095	-0.00037	0.00185	-0.00113
I.C.D.C Inve	0.00469	0.00403	0.00190	0.00340	0.00833	0.00673	0.00554	0.00552	0.00453	0.00323	0.00443	0.00616	0.00653	0.00609	0.00352
Jubilee Hol	0.00014	-0.00007	0.00073	0.00009	-0.00006	0.00002	0.00019	0.00071	0.00018	0.00019	0.00021	0.00014	-0.00003	0.00039	0.00129
Kenya Com	0.00102	0.00033	0.00037	0.00011	0.00022	0.00176	0.00071	0.00097	0.00061	-0.00002	0.00056	0.00047	0.00012	0.00158	0.00052
National Ba	0.00067	0.00073	0.00121	0.00092	0.00138	0.00208	0.00189	0.00136	0.00150	0.00055	0.00080	0.00183	0.00144	0.00095	0.00061
NIC Bank L	0.00113	0.00086	0.00053	0.00089	0.00077	0.00073	0.00134	0.00050	0.00329	0.00057	0.00123	0.00048	0.00045	0.00106	0.00059
Pan Africa I	-0.00010	-0.00021	-0.00001	-0.00024	-0.00021	0.00176	0.00007	-0.00025	-0.00027	-0.00027	-0.00025	0.00161	-0.00024	-0.00027	-0.00026
Standard C	0.00001	-0.00003	-0.00001	-0.00003	0.00003	-0.00004	0.00031	0.00004	-0.00002	-0.00001	-0.00004	-0.00002	-0.00001	0.00004	0.00002
Athi River M	0.00051	0.00112	0.00004	0.00113	0.00068	0.00032	0.00090	0.00059	0.00021	0.00038	0.00015	0.00014	0.00002	0.00017	0.00365
Bamburi Ce	-0.00006	-0.00002	-0.00006	0.00012	-0.00005	-0.00002	-0.00003	0.00004	0.00001	-0.00006	0.00038	-0.00000	-0.00005	-0.00005	-0.00005
British Ame	0.00018	0.00020	0.00036	0.00037	0.00008	0.00079	0.00021	0.00040	0.00038	0.00022	0.00083	0.00029	0.00174	0.00009	0.00007
Crown Berg	0.00010	-0.00058	-0.00045	-0.00040	-0.00018	-0.00052	-0.00025	-0.00047	0.00130	-0.00061	0.00124	-0.00044	0.00043	0.00169	-0.00050
E.A.Portlan	-0.00001	0.00020	-0.00003	0.00001	-0.00001	-0.00002	0.00001	0.00007	0.00001	-0.00002	-0.00002	0.00004	0.00000	0.00007	-0.00003
East African	0.00019	0.00029	0.00017	0.00035	0.00024	0.00011	0.00029	0.00042	0.00032	0.00011	0.00019	0.00044	0.00006	0.00006	0.00047
Kenya Oil C	0.00032	0.00029	0.00024	0.00019	0.00034	0.00032	0.00024	0.00034	0.00029	0.00023	0.00020	0.00056	0.00323	0.00476	0.01264
Kenya Pow	0.00502	0.00728	0.00374	0.00661	0.01028	0.00951	0.00510	0.00900	0.00147	0.00244	0.00204	0.00992	0.00242	0.00204	0.00264
Mumias Sug	0.00081	0.00034	0.00204	0.00053	0.00033	0.00267	0.00124	0.00118	0.00101	0.00332	0.00092	0.00391	0.00263	0.00061	0.00037
Olympia Ca	0.00029	0.00016	0.00004	0.00007	0.00077	0.00000	0.00007	0.00001	0.00051	0.00074	0.00021	0.00224	0.00023	0.00248	0.00000
Sameer Afr	0.00011	0.00063	0.00034	0.00015	0.00016	0.00058	0.00157	0.00024	0.00012	0.00025	0.00008	0.00034	0.00045	0.00043	0.00088
Total Kenya	0.00040	0.00040	0.00037	0.00063	0.00052	0.00039	0.00098	0.00134	0.00068	0.00034	0.00078	0.00031	0.00064	0.00090	0.00046
Unga Grou	0.00071	0.00104	0.00091	0.00068	0.00061	0.00047	0.00028	0.00029	0.00129	0.00054	0.00019	-0.00002	0.00009	0.00200	0.00031
A.Baumann	0.00406	0.00380	0.00419	0.00385	0.00406	0.00380	0.00458	0.00383	0.00380	0.00380	0.00393	0.00380	0.00401	0.00392	0.00380
City Trust L	0.00034	0.00013	0.00041	-0.00002	0.00014	0.00027	-0.00014	-0.00014	-0.00014	-0.00014	-0.00014	-0.00014	-0.00014	0.00010	-0.00014
Eaagads Lt	-0.00001	0.00001	-0.00001	-0.00001	0.00006	-0.00001	0.00052	-0.00000	0.00099	0.00097	0.00012	-0.00001	0.00123	0.00017	0.00015
Express Ltd	-0.00268	-0.00082	0.00050	0.00012	0.00437	0.00062	0.00048	0.00185	0.00082	-0.00052	-0.00047	-0.00062	-0.00108	-0.00043	-0.00039
Williamson	0.00002	-0.00003	-0.00003	-0.00003	0.00109	-0.00003	0.00028	-0.00003	-0.00003	-0.00003	0.00003	-0.00003	0.00022	0.00214	0.00015
Kapchorua	0.00001	0.00001	0.00001	0.00001	0.00104	0.00001	0.00006	0.00001	0.00004	0.00017	0.00001	0.00001	0.00001	0.00001	0.00001
Standard G	0.00059	0.00032	0.00010	0.00008	0.00044	0.00076	0.00172	0.00048	0.00074	0.00035	0.00026	0.00006	0.00018	0.00010	0.00025

Appendix 7.4 Turn over ratios for all the sampled companies within the event window

Days	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
Securities	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio
Unilever Tea	-	0.00002	-	-	-	0.00018	0.00001	-	0.00002	-	0.00009	-	-	0.00009	0.00002	0.00007
Kakuzi Ord.5	-	-	-	-	-	0.00006	-	-	0.00003	-	-	-	-	0.00035	0.00030	0.00004
Rea Vipingo	0.00177	0.00121	0.00098	0.00243	0.00056	0.00022	0.00049	0.00027	0.00012	0.00011	0.00025	0.00013	0.00010	0.00052	0.00319	0.00157
Sasini Tea &	0.00025	0.00020	0.00045	0.00031	0.00047	0.00032	0.00073	0.00063	0.00025	0.00095	0.00249	0.00129	0.00148	0.02753	0.00137	0.00069
Car & Genera	-	-	0.00055	0.00055	0.00018	0.00018	-	0.00003	-	-	-	-	-	-	-	-
CMC Holding	0.00135	0.00652	0.00483	0.00069	0.00023	0.00052	0.00002	0.00004	0.00099	0.00041	0.00054	0.00422	0.00434	0.00148	0.00132	0.00061
Kenya Airwa	0.00015	0.00072	0.00093	0.00095	0.00023	0.00030	0.00027	0.00065	0.00036	0.00040	0.00041	0.00130	0.00019	0.00031	0.00057	0.00022
Marshalls (E.	-	-	-	-	0.00007	-	-	-	-	0.00042	0.00028	0.00001	0.00069	-	-	-
Nation Medi	0.00020	0.00098	0.00055	0.00008	0.00003	0.00002	0.00002	0.00005	0.00016	0.00012	0.00008	0.00019	0.00003	0.00003	0.00003	0.00008
TPS Ltd Ord 5	0.00019	0.00003	0.00001	0.00005	0.00053	0.00008	0.03401	0.00501	0.01748	0.02088	0.04236	0.07760	0.02815	0.03234	0.01737	0.00601
Barclays Ban	0.00026	0.00010	0.00110	0.00055	0.00032	0.00011	0.00011	0.00035	0.00031	0.00003	0.00018	0.00019	0.00009	0.00037	0.00131	0.00004
C.F.C Bank Lt	0.00001	0.00087	0.00005	0.00005	0.00004	0.00000	0.00012	0.00041	0.00059	0.00002	0.00034	0.00003	0.00074	0.00090	0.00002	0.00001
Diamond Tru	0.00009	0.00016	0.00096	0.00024	0.00046	0.00007	0.00026	0.00041	0.00005	0.00002	0.00011	0.00110	0.00191	0.00439	0.00196	0.00018
Housing Fina	0.00031	0.00027	0.00038	0.00051	0.00055	0.00042	0.00050	0.00039	0.00105	0.00050	0.00040	0.00076	0.00154	0.00029	0.00055	0.00132
I.C.D.C Inves	0.00677	0.01672	0.00485	0.00340	0.00844	0.00096	0.00300	0.01498	0.00129	0.00217	0.00206	0.00131	0.00191	0.00382	0.00213	0.00281
Jubilee Holdi	0.00005	0.00085	0.00001	0.00010	0.00026	0.00003	0.00002	0.00000	0.00002	0.00001	0.00015	0.00033	0.00015	-	0.00007	0.00009
Kenya Comm	0.00032	0.00026	0.00048	0.00066	0.00078	0.00141	0.00122	0.00135	0.00162	0.00020	0.00069	0.00060	0.00065	0.00102	0.00032	0.00101
National Ban	0.00073	0.00174	0.00096	0.00060	0.00066	0.00033	0.00028	0.00051	0.00096	0.00039	0.00037	0.00013	0.00034	0.00079	0.00065	0.00066
NIC Bank Ltd	0.00061	0.00007	0.00108	0.00064	0.00008	0.00091	0.00052	0.00016	0.00001	0.00050	0.00064	0.00032	0.00023	0.00033	0.00005	0.00016
Pan Africa In	0.00001	0.00015	0.00541	0.00111	0.00625	-	0.00010	-	0.00007	0.00003	0.00015	-	-	0.00003	0.00002	0.00002
Standard Cha	0.00006	0.00004	0.00004	0.00006	0.00016	0.00004	0.00004	0.00144	0.00081	0.00031	0.00005	0.00075	0.00094	0.00002	0.00005	0.00029
Athi River M	0.00033	0.00390	0.00076	0.00104	0.00135	0.00149	0.00128	0.00129	0.00060	0.00110	0.00107	0.00045	0.00095	0.00032	0.00107	0.00086
Bamburi Cen	0.00000	0.00004	0.00001	0.00042	0.00005	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00049	0.00029	-	0.00001
British Amer	0.00000	0.00008	0.00262	0.00052	0.00002	0.00002	0.00000	0.00005	0.00112	0.00002	0.00001	0.00002	0.00012	0.00013	0.00013	0.00011
Crown Berge	0.00024	0.00060	0.00002	-	0.00066	0.00015	-	-	-	-	0.00005	0.00012	-	0.00045	0.00057	0.00048
E.A.Portland	0.00012	-	0.00003	0.00000	0.00033	0.00000	-	0.00001	0.00002	-	-	-	-	0.00001	0.00003	0.00004
East African B	0.00020	0.00008	0.00012	0.00005	0.00002	0.00058	0.00034	0.00093	0.00014	0.00002	0.00003	0.00001	0.00019	0.00023	0.00043	0.00005
Kenya Oil Co	0.00002	0.00002	0.00002	0.00003	-	0.00004	-	-	0.00002	-	0.00003	-	-	0.00009	0.00000	0.00010
Kenya Powe	0.01539	0.00984	0.00490	0.00038	0.00048	0.00381	0.00126	0.00348	0.00317	0.00333	0.00151	0.00355	0.00202	0.00276	0.00537	0.00112
Mumias Suga	0.00054	0.00220	0.00081	0.00113	0.00153	0.00059	0.00088	0.00140	0.00085	0.00104	0.00056	0.00056	0.00102	0.00117	0.00109	0.00028
Olympia Cap	-	-	-	-	-	0.00005	-	-	-	-	0.00011	-	-	-	-	0.00031
Sameer Afric	0.00067	0.00006	0.00051	0.00031	0.00019	0.00024	0.00018	0.00007	0.00001	0.00026	0.00035	0.00006	0.00060	0.00038	0.00008	0.00058
Total Kenya	0.00098	0.00270	0.00097	0.00023	0.00013	0.00043	0.00011	0.00005	0.00254	0.00024	0.00011	0.00002	0.00016	0.00058	0.00145	0.00015
Unga Group	0.00077	0.00032	0.00121	0.00219	0.00064	0.00242	0.00065	0.00128	0.00111	0.00008	0.00016	0.00078	0.00006	0.00001	0.00181	0.00025
A.Baumann	-	-	-	-	0.00023	-	-	-	-	-	-	-	-	-	-	-
City Trust Ltd	-	-	0.00079	0.00072	-	-	-	-	0.00105	-	-	-	-	-	-	-
Eaagads Ltd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Express Ltd C	0.00416	0.00609	0.00091	0.00136	0.00099	0.00128	-	0.00025	0.00022	0.00081	0.00036	0.00056	0.00034	0.00048	0.00063	0.00070
Williamson T	-	0.00034	0.00098	-	0.00081	0.00091	0.00046	-	-	-	-	-	-	-	0.00206	0.00034
Kapchorua T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Standard Gro	0.00039	0.00045	0.00010	0.00097	0.00026	0.00036	0.00018	0.00010	0.00008	0.00030	0.00005	0.00002	-	0.00041	0.00001	0.00005

Appendix 7.4 (continuation)

Days	1	2	3	4	5	6	7	8
Securities	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio
Unilever Tea	0.00002	0.00008	0.00005	0.00004	0.00002	0.00004	0.00001	0.00002
Kakuzi Ord.5	0.00043	0.00004	0.00070	0.00086	0.00028	0.00215	0.00178	0.00045
Rea Vipingo	0.00141	0.00226	0.00073	0.00106	0.00292	0.00880	0.00157	0.00335
Sasini Tea &	0.00125	0.00161	0.00129	0.00100	0.00554	0.00129	0.00382	0.00109
Car & Genera	-	0.00004	-	0.00058	0.00267	0.00180	-	-
CMC Holding	0.00246	0.00339	0.00192	0.00194	0.00840	0.00154	0.00251	0.00354
Kenya Airway	0.00171	0.00096	0.00026	0.00097	0.00107	0.00153	0.00253	0.00192
Marshalls (E.	0.00002	-	0.00028	0.00006	0.00007	-	0.00001	0.00007
Nation Media	0.00006	0.00003	0.00005	0.00004	0.00169	0.00021	0.00074	0.00003
TPS Ltd Ord 5	0.01575	0.01886	0.01701	0.02670	0.01746	0.02062	0.01067	0.01679
Barclays Ban	0.00009	0.00074	0.00007	0.00009	0.00014	0.00010	0.00031	0.00029
C.F.C Bank Lt	0.00003	0.00003	0.00107	0.00027	0.00020	0.00005	0.00019	0.00021
Diamond Tru	0.00130	0.00028	0.00031	0.00053	0.00017	0.00207	0.00109	0.00156
Housing Fina	0.00010	0.00295	0.00087	0.00116	0.00054	0.00045	0.00081	0.00151
I.C.D.C Inves	0.00439	0.00373	0.00161	0.00310	0.00803	0.00643	0.00524	0.00522
Jubilee Holdi	0.00024	0.00003	0.00082	0.00019	0.00003	0.00011	0.00029	0.00081
Kenya Comm	0.00137	0.00067	0.00072	0.00045	0.00056	0.00211	0.00105	0.00131
National Ban	0.00074	0.00081	0.00128	0.00100	0.00145	0.00216	0.00196	0.00143
NIC Bank Ltd	0.00099	0.00072	0.00038	0.00075	0.00062	0.00059	0.00120	0.00036
Pan Africa In	0.00017	0.00006	0.00026	0.00003	0.00006	0.00203	0.00034	0.00002
Standard Cha	0.00009	0.00004	0.00007	0.00005	0.00011	0.00004	0.00039	0.00012
Athi River M	0.00107	0.00168	0.00060	0.00170	0.00124	0.00088	0.00147	0.00115
Bamburi Cen	-	0.00005	0.00001	0.00018	0.00001	0.00004	0.00004	0.00010
British Amer	0.00012	0.00014	0.00030	0.00031	0.00001	0.00072	0.00014	0.00034
Crown Berge	0.00089	0.00021	0.00034	0.00039	0.00061	0.00027	0.00054	0.00032
E.A.Portland	0.00003	0.00023	0.00001	0.00004	0.00002	0.00001	0.00004	0.00010
East African	0.00019	0.00029	0.00016	0.00034	0.00024	0.00011	0.00029	0.00041
Kenya Oil Co	0.00019	0.00016	0.00011	0.00006	0.00020	0.00018	0.00011	0.00021
Kenya Powe	0.00467	0.00693	0.00339	0.00626	0.00993	0.00916	0.00475	0.00865
Mumias Suga	0.00131	0.00083	0.00253	0.00102	0.00082	0.00316	0.00173	0.00167
Olympia Cap	0.00029	0.00016	0.00004	0.00007	0.00077	-	0.00007	0.00001
Sameer Afric	0.00021	0.00073	0.00045	0.00025	0.00026	0.00068	0.00168	0.00035
Total Kenya	0.00020	0.00020	0.00017	0.00043	0.00032	0.00019	0.00078	0.00114
Unga Group	0.00085	0.00119	0.00106	0.00082	0.00076	0.00062	0.00042	0.00043
A.Baumann	0.00026	-	0.00039	0.00005	0.00026	-	0.00078	0.00003
City Trust Ltd	0.00048	0.00026	0.00055	0.00012	-	0.00041	-	-
Eaagads Ltd	-	0.00002	-	-	0.00007	-	0.00053	0.00001
Express Ltd C	0.00426	0.00077	0.00208	0.00171	0.00595	0.00221	0.00206	0.00344
Williamson T	0.00005	-	-	-	0.00112	-	0.00031	-
Kapchorua T	-	-	-	-	0.00102	-	0.00005	-
Standard Gr	0.00058	0.00031	0.00010	0.00007	0.00043	0.00075	0.00171	0.00047

9	10	11	12	13	14	15
n Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio	Turn Over ratio
0.00001	0.00001	0.00001	0.00006	0.00012	-	0.00020
0.00013	0.00012	0.00032	0.00023	0.00043	0.00021	0.00018
0.00174	0.00120	0.00110	0.00126	0.00058	0.00129	0.00304
0.01672	0.00193	0.00159	0.00102	0.00341	0.00202	0.00249
0.00002	0.00025	-	0.00109	0.00057	0.00069	0.00108
0.00645	0.00605	0.00501	0.00047	0.00450	0.00043	0.00046
0.00114	0.00036	0.00129	0.00049	0.00066	0.00035	0.00034
0.00014	0.00070	0.00056	0.00009	-	-	-
0.00071	0.00054	0.00067	0.00035	0.00019	0.00010	0.00018
0.01730	0.02156	0.00718	0.01778	0.00664	0.01781	0.01021
0.00038	0.00005	0.00089	0.00014	0.00038	0.00027	0.00012
0.00007	0.00099	0.00007	0.00005	0.00008	0.00011	0.00012
0.00071	0.00070	0.00129	0.00061	0.00072	0.00296	0.00151
0.00226	0.00037	0.00085	0.00065	0.00123	0.00345	0.00047
0.00423	0.00294	0.00414	0.00586	0.00623	0.00579	0.00322
0.00028	0.00029	0.00030	0.00024	0.00007	0.00048	0.00139
0.00095	0.00032	0.00090	0.00081	0.00046	0.00193	0.00087
0.00158	0.00063	0.00088	0.00191	0.00152	0.00103	0.00069
0.00314	0.00043	0.00108	0.00033	0.00031	0.00091	0.00045
-	0.00000	0.00002	0.00188	0.00003	-	0.00001
0.00006	0.00007	0.00004	0.00006	0.00007	0.00012	0.00009
0.00077	0.00095	0.00072	0.00070	0.00059	0.00073	0.00422
0.00007	0.00000	0.00045	0.00006	0.00001	0.00002	0.00002
0.00032	0.00016	0.00077	0.00023	0.00168	0.00003	0.00001
0.00209	0.00018	0.00203	0.00035	0.00122	0.00248	0.00029
0.00004	0.00001	0.00001	0.00007	0.00003	0.00010	-
0.00031	0.00011	0.00019	0.00043	0.00006	0.00006	0.00046
0.00016	0.00010	0.00007	0.00043	0.00310	0.00463	0.01251
0.00112	0.00209	0.00169	0.00957	0.00207	0.00169	0.00229
0.00150	0.00382	0.00141	0.00441	0.00312	0.00110	0.00086
0.00051	0.00074	0.00020	0.00224	0.00023	0.00248	-
0.00023	0.00035	0.00019	0.00044	0.00056	0.00054	0.00099
0.00047	0.00013	0.00058	0.00011	0.00044	0.00069	0.00026
0.00144	0.00069	0.00034	0.00013	0.00023	0.00215	0.00045
-	-	0.00013	-	0.00021	0.00012	-
-	-	-	-	-	0.00024	-
0.00101	0.00098	0.00014	-	0.00124	0.00019	0.00016
0.00241	0.00107	0.00111	0.00097	0.00051	0.00115	0.00120
-	-	0.00006	-	0.00025	0.00217	0.00018
0.00003	0.00015	-	-	-	-	-
0.00073	0.00035	0.00026	0.00005	0.00018	0.00010	0.00024

Appendix 7.4 Performance in both MIMS and AIMS

MIMS							AIMS						
	Return Residues		Volume Residues		Turn over ratio(LIQ)			Return Residues		Volume Residues		Turn over ratio(LIQ)	
Days	Mean Resid	Std Dev	Mean	Std Dev	Mean	Std Dev	Days	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
-15	0.02165	0.07450	0.00081	0.00294	0.00095	0.00281	-15	-0.00566	0.03879	0.00094	0.00158	0.00065	0.00155
-14	0.01780	0.06866	0.00135	0.00345	0.00149	0.00339	-14	-0.01266	0.05325	0.00128	0.00198	0.00098	0.00226
-13	0.02187	0.06789	0.00090	0.00161	0.00105	0.00157	-13	0.00421	0.05200	0.00069	0.00147	0.00040	0.00047
-12	0.02634	0.07109	0.00042	0.00089	0.00057	0.00077	-12	-0.00808	0.05348	0.00073	0.00142	0.00044	0.00057
-11	0.01918	0.06849	0.00061	0.00180	0.00076	0.00173	-11	-0.00859	0.04791	0.00062	0.00156	0.00033	0.00041
-10	0.01782	0.07417	0.00033	0.00091	0.00047	0.00079	-10	-0.00743	0.04993	0.00066	0.00144	0.00036	0.00053
-9	0.02179	0.07288	0.00122	0.00582	0.00137	0.00580	-9	-0.00600	0.04781	0.00038	0.00164	0.00009	0.00018
-8	0.02105	0.06992	0.00089	0.00279	0.00104	0.00268	-8	-0.01756	0.06912	0.00034	0.00160	0.00005	0.00010
-7	0.01591	0.07372	0.00091	0.00303	0.00105	0.00300	-7	0.00005	0.04914	0.00049	0.00161	0.00019	0.00039
-6	0.02057	0.08173	0.00084	0.00362	0.00099	0.00358	-6	-0.00516	0.04963	0.00045	0.00151	0.00016	0.00031
-5	0.01713	0.06636	0.00149	0.00724	0.00164	0.00722	-5	-0.00432	0.05146	0.00035	0.00159	0.00006	0.00014
-4	0.02171	0.07394	0.00267	0.01325	0.00282	0.01325	-4	-0.00362	0.04758	0.00037	0.00156	0.00008	0.00021
-3	0.02322	0.07168	0.00130	0.00479	0.00144	0.00480	-3	-0.01369	0.06112	0.00034	0.00159	0.00005	0.00013
-2	0.02316	0.07838	0.00224	0.00710	0.00238	0.00709	-2	0.00128	0.03877	0.00042	0.00156	0.00013	0.00022
-1	0.02587	0.07183	0.00113	0.00311	0.00128	0.00306	-1	-0.00602	0.04781	0.00068	0.00165	0.00039	0.00077
0	0.03647	0.09183	0.00045	0.00118	0.00059	0.00112	0	0.00163	0.04077	0.00045	0.00152	0.00015	0.00027
1	0.02426	0.07866	0.00111	0.00284	0.00125	0.00280	1	-0.00939	0.07771	0.00110	0.00162	0.00080	0.00154
2	0.02758	0.09385	0.00133	0.00340	0.00148	0.00340	2	0.00853	0.07926	0.00049	0.00150	0.00020	0.00029
3	0.03830	0.08705	0.00100	0.00293	0.00114	0.00291	3	0.00592	0.06825	0.00074	0.00154	0.00045	0.00075
4	0.04759	0.08111	0.00141	0.00462	0.00155	0.00459	4	0.00537	0.06453	0.00057	0.00145	0.00028	0.00063
5	0.04413	0.09430	0.00183	0.00377	0.00198	0.00375	5	-0.01000	0.06268	0.00156	0.00187	0.00127	0.00211
6	0.02507	0.07222	0.00192	0.00409	0.00206	0.00400	6	0.01144	0.06003	0.00077	0.00137	0.00048	0.00081
7	0.02335	0.06865	0.00128	0.00216	0.00143	0.00210	7	-0.00711	0.03409	0.00107	0.00166	0.00078	0.00081
8	-0.00750	0.08388	0.00147	0.00325	0.00162	0.00321	8	-0.00881	0.04743	0.00086	0.00148	0.00056	0.00128
9	0.01768	0.08982	0.00183	0.00400	0.00197	0.00405	9	-0.02156	0.06478	0.00089	0.00136	0.00060	0.00090
10	0.01458	0.07360	0.00129	0.00375	0.00144	0.00377	10	-0.01010	0.04496	0.00066	0.00146	0.00036	0.00047
11	0.02714	0.08421	0.00094	0.00149	0.00108	0.00153	11	-0.01864	0.04598	0.00053	0.00152	0.00024	0.00039
12	0.03229	0.07474	0.00146	0.00353	0.00160	0.00345	12	0.00655	0.06690	0.00044	0.00150	0.00015	0.00036
13	0.02531	0.08376	0.00108	0.00172	0.00122	0.00173	13	-0.01042	0.02253	0.00063	0.00163	0.00034	0.00043
14	0.02790	0.08753	0.00152	0.00320	0.00167	0.00318	14	-0.00639	0.07300	0.00086	0.00158	0.00057	0.00081
15	0.01336	0.07286	0.00131	0.00282	0.00145	0.00274	15	-0.01216	0.06186	0.00055	0.00145	0.00025	0.00043