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Abstract
Many stock markets in developing countries are thin, suffer from low liquidity and operate within unstable macro-economic environments. To improve their efficiency levels, markets have embarked on implementing a raft of reforms hoped to propel them towards development. Between 2002 and 2006, a series of reforms were undertaken at the Nairobi Securities Exchange (NSE). Whether these reforms have improved the efficiency of the market still remains unknown. The purpose of this study was to examine the impact of capital markets reforms on the efficiency of the NSE. Using data collected on the NSE-20 Share Index and divided into pre-reform period and post-reform period, the monthly index return was computed as the first difference of the logarithmic share Index. Normality tests were performed using skewness, kurtosis and Ryan-Joiner test to assess the distribution of returns. The efficiency of the market was tested using the Non-parametric runs test to uncover any independency of returns. Finally, the Wilcoxon signed rank test was used to determine the impact of reforms on the price discovery process. Results revealed that mean returns in the post-reform period were higher than mean returns in the pre-reform period, though with higher volatility. This was as a result of an improved price discovery process following reforms. The higher volatility in the post-reform is attributable to the automation of the depository and trading systems. The returns were more random in the post-reform period implying that the market had improved in efficiency, providing support for the Adaptive Market Hypothesis. Licensing of more market makers and adoption of a mixed trading system can further improve market efficiency.

KEY WORDS: *Market Efficiency, Adaptive Efficiency, Market Reforms, Nairobi Securities Exchange*

1. Introduction

Securities markets enable firms to easily raise finance, while ensuring efficient capital allocation in an economy. They also contribute to price discovery, provide liquidity, assist in risk transfer, facilitate corporate governance, and provide a measure of company performance. Financial economists, investment managers and market authorities are concerned with the efficiency of securities markets because the ability of securities markets to perform their critical functions depends on their level of efficiency.

A securities market is said to be informational efficient if security prices at any time fully reflect all the available information (Fama, 1970). The more efficient the market, the more random the sequence of price changes generated by such a market. The most efficient market is one in which prices are completely random and unpredictable (Lo, 2004). Until the 1970s, securities markets were believed to be informational efficient until market anomalies started to be documented. These market anomalies seemed to be at odds with the efficient markets theory (EMT) and led to the emergence of behavioural finance. According to the proponents of behavioural finance, markets are not absolutely efficient as portrayed by the EMT but rather relatively efficient (Chuvakhin, 2000).

Recently, there has been an attempt to reconcile these two opposing schools of thoughts which has given rise to the Adaptive Markets Efficiency (AME). The AME states that market efficiency is not an all or none condition but is a characteristic that varies overtime. As such market efficiency is highly context dependant as influenced by environmental factors such as regulatory reforms, number of participants and micro structural changes (Lo, 2005) undertaken in a market. Whether this new theory will end the debate as to whether securities markets are efficient or not is yet to be established but it gives a better understanding as to why some markets are found to be efficient at some period and inefficient at another period or rather why some markets are more efficient than others.

The efficiency of African securities markets is still low compared to their emerging markets counterparts in Asia and Latin America. Although a study by Magnusson and Wydick (2002) revealed that emerging stock markets in Africa, Latin America and Asia are at the same level in terms of efficiency, markets in Latin America and Asia continue to attract more international investors. This is in contrast to African markets which lag behind due to their low liquidity and poor price formation (Owido et al., 2013), majority of which are considered as frontier markets. With the exception of South Africa, most African securities markets suffer from low capitalisation and with few listed companies (Yartey and Adjasi, 2007). It is these challenges that have prompted African markets to undertake microstructure improvements and regulatory changes so as to increase liquidity and transparency, enhance efficiency, and reduce transaction costs and price volatility. Despite their small size and low liquidity,

African markets continue to perform remarkably well in terms of return on investment (Allen, et al., 2012). Their lack of integration due to low correlation with global equity markets makes them good portfolio diversifiers (Kodongo and Ojah, 2012; Mühlberger, 2009). This potential has generated a lot of interest in African securities markets.

The Nairobi Securities Exchange (NSE), with 63 listed firms, has been undertaking reforms in order to bring it at par with other emerging markets. The Capital Markets Authority (CMA) has been instrumental in implementing policy and institutional reforms in the Kenyan capital markets. For example, in 2006, the CMA and NSE have been instrumental in ensuring that the market was fully automated. This has significantly improved market liquidity (turnover) and size (capitalisation) and boosted the operational efficiency of the market. The various market reforms have led to increased participation from local and institutional investors leading to oversubscribed IPOs (CMA, 2010). It is on the backdrop of these reforms that led to renewed market activity which saw the NSE-20 Share Index registering an all-time high on 12th February 2007 of 6060.48 points. However, recent political events, terrorists' attacks and the collapse of various brokerage firms have provided lots of challenges to the performance, growth and development of the NSE as many retail investors seem to shy away from the market. It is such challenges and many more that have called for more reforms inform of increased market surveillance and demutualization so as to increase market efficiency (Onyuma, 2012; Onyuma and Ouma, 2007).

Studies have been done on stock market efficiency both in Kenya and elsewhere. However, few studies have examined the effect of market reforms on market efficiency particularly in African markets. Additionally, studies done on weak form efficiency have resulted into adopting a fixed approach when testing efficiency which results into the conclusion that a market is weak form efficient or inefficient. This tends to ignore the environmental factors that may influence market efficiency. According to the AME championed by Lo (2004; 2005), market efficiency is highly context dependant as influenced by environment factors such as regulatory changes, microstructure improvement and the number of market participants. As a result, the efficiency of the market may change as influenced by these factors. Thus, a more appropriate way to look at market efficiency would be whether the market is becoming more efficient as a result of these factors rather than concluding that the market is weak form efficient or inefficient. Furthermore, one of the main goals of the Kenyan government in carrying out various reforms is to improve market efficiency. Whether these reforms have attained this objective in Kenya still remains unknown.

The purpose of this study was therefore to determine whether the introduction of market reforms in Kenya has led to improved market efficiency at the NSE. The study determined whether: returns at the NSE follow a normal distribution, affect the price discovery process and return volatility – the market efficiency.

1.1 Market Reforms at the Kenyan Securities Market

The NSE was established in 1954 as a voluntary association of stockbrokers and later registered under the Societies Act (NSE, 2012). The establishment of the NSE marked the formalization of share trading and was initiated by stockbrokers who saw the need to access long term capital by private enterprises. A self regulatory framework was also adopted and embodied in the Rules and Regulations of NSE. Business was transacted over the telephone and prices were determined through negotiation and trading was also restricted to the resident European community until 1963, when Kenya attained independence.

After independence, withholding tax was charged at 12.5 percent for non-residents in an effort to control repatriation of funds and raise Government revenue (Ngugi, 2003). The tight taxation measures adopted by the government were counterproductive as they discouraged new listings and capital market development. In 1984, a joint study was undertaken by the Central Bank of Kenya (CBK) and the International Finance Corporation (IFC) with the aim of developing and strengthening the capital and money markets (CMA, 2006).The findings of this study culminated into a series of reforms in the market. For instance, the Capital Markets Authority (CMA) was established in 1989 through the Capital Market Act (Cap485A) to complement the self regulation framework previously in place by the NSE (CMA, 2010). A series of taxation reforms were also introduced such as the abolishment of the capital gains tax, reduction of withholding tax to15% on dividends paid to residents and removal of stamp duty payable on transfer of quoted shares. Further, trading was moved from the coffee-house to floor based open outcry system (Okumu, 2013).

In order to address these challenges such as globalization of capital markets, emergence of new technology for trading and settlement, increased competition among capital markets, need for strong institutional market players, need for alternative savings vehicles and need for new methods of financing, the CMA set up a market reform programme – Seven Pronged market Reform Agenda in 1999 to address the challenges (CMA, 2006). This Agenda was to be implemented in collaboration with the NSE, culminating in the following market reforms.

For instance, the Capital Market Authority Act was amended and renamed the Capital Markets Act in 2000, leading to the development of various regulations and guidelines such as the introduction of collective investment schemes regulations (2001), the public offers, listings and disclosures regulations (2002), the licensing requirements and general regulations (2002), the takeover and mergers regulations (2002), the foreign investor regulations (2002), the corporate governance guidelines for public listed companies (2002) and the guidelines on approval and registration of credit rating agencies (2002) (NSE, 2013). These were expected to improve market transparency, investor confidence and provide alternative investment vehicles.

The need to improve the market infrastructure was brought about by the pitfalls in the manual system that was in place. For instance, it would take about two weeks between the actual sale and confirmation of trades – thus affecting liquidity and efficiency of the market. The Central Depository and Settlement Corporation Limited (CDSC) was established on 23rd March 1999 and the CDS Act gazetted on 25th August 2000 (CMA, 2000). On 23rd November 2004, a Central Depository System (CDS) was launched to shorten the registration process, fasten the ownership transfer, boost liquidity in the market, increase market activity (Onyuma, 2012).

On 1st August 2000, a delivery versus payment system (DvP) of T+7 was introduced as the initial step towards moving to the electronic system of settlement to shorten the process (NSE, 2013). In order deepen the capital market, the CMA reorganized the stock market in January 2001 classifying the market into the Main Investment Markets (MIMs), the Alternative Investment Markets (AIMs) and the Fixed Income Securities Markets (FISMs). In order to increase liquidity in the fixed income markets, the Government made it compulsory for insurance companies to invest 25 percent of their gross premium in Government securities (Ngugi, 2005).

The Finance Bill 2004 introduced amendments to the Capital Markets Act and empowered CMA to license Special Purpose Vehicles (SPVs) to facilitate securitization (CMA, 2006). Further, investment income of SPVs was exempted from income tax to encourage institutions providing infrastructural services to set up SPVs for purposes of issuing Asset Backed Securities (CMA, 2010). In 2006, the government further exempted interest income accruing from all listed bonds with at least a maturity period of three years. This incentive targeted institutions providing infrastructural services (CMA, 2006), and additionally, the authority drafted regulations on Asset Backed Securities and Venture Capital funds.

The amendments of the CMA Act in 2000 gave the authority the much needed powers to license and regulate new institutional players such as Investment Banks, Credit Rating Agencies and Authorized Securities Dealers (ASD). The CMA also encouraged the replacement of retail stock brokers with investment banks through consolidation, acquisition and transformation. The number of investment banks has grown over the years from two in 2000 to nineteen in 2010 (CMA, 2010).

The CMA also introduced a compliance and enforcement programme as part of strengthening its institutional framework, which involve conducting market surveillance and carrying out regular inspections on capital markets institutions to ensure compliance with the licensing requirements and general regulations. The authority also imposed continuous reporting obligations on listed firms which saw suspension from trading and/or delisting of firms which did not comply with the continuous reporting obligations and listing requirements such as Kenya Hotels, Kenya Finance Bank, Hutchings Biemer, Pearl Dry Cleaners, Lornho Motors, Theta Group and Regent Undervalued Assets (CMA, 2002). This was meant to improve good corporate governance practices in listed firms.

To encourage new listings, listing companies were exempted from stamp duty and taxed at a reduced rate of 27% as opposed to the usual 30% for next three years provided they offer 20% of their share capital (CMA, 2001). This tax exempt status was extended to collective investment schemes set up by employers on behalf of employees to invest in listed shares so as to encourage savings (CMA, 2006). Further, to encourage employers to set up Employee Share Ownership Plans (ESOPs) and to make such schemes attractive to employees, the government in 2006 directed that as part of employee benefit to only subject to tax the difference between the subscription price and the market value of securities (CMA , 2006). Also, listing companies were offered tax amnesty on their past omitted income, provided they make a full disclosure of their assets and liabilities and undertake to pay all their future due taxes.

Additionally, in 2002/03 fiscal year any newly listed companies that offered 30 percent of their share capital were to enjoy a corporate tax rate of 25 percent for a period of five years. In 2005, newly listed companies were to pay corporation tax at a lower rate of 20 percent, for a period of 5 years, provided these companies offer at least 40 percent of their shares to the public (Ngugi, 2005). Further, in order to promote listings at the NSE, the government in 2006 approved the deduction of capital expenditure incurred by a company on legal costs, and other incidental expenses while being processed for listing without raising additional capital.

In order to improve trading speed, boost trading volumes, and enable remote trading by stockbrokers and

increase transparency, an automated trading system (ATS) was installed on 11th September 2006 (Okumu, 2013). The introduction of CDS and ATS has increased trading hours from 10am to 3pm and reduced settlement period to T+3.

In 2007, cases of insider trading, unauthorized sale of clients' share by brokers, and the collapse of brokerage firms have led to loss of investor confidence and decreased activity in the stock market. To address this challenge, the CMA introduced a Capital Market Fraud Investigation Unit to assist in fraud investigations (CMA, 2010), and imposed continuous reporting obligations to investment banks and brokerage firms as well as increased their minimal capital requirements so as to protect investor's interest. The CMA also adopted a Risk Based Supervision model to assist in directing its efforts to those areas that are considered to be high risk (CMA, 2010). All these efforts were meant to strengthen the capital market intermediaries as well as promote good governance. Currently, the NSE is pursuing demutualization in order to boost investor confidence and strengthen its own corporate governance structures. In addition, the CMA has improving its market infrastructure by introducing a Broker Back Office (BBO) and Capizar Electronic Market surveillance to improve the existing internal risk management infrastructure of the members and the market surveillance infrastructure of the regulator (Okumu, 2013).

To further deepen the capital market, the Finance Bill 2010 proposed the introduction of a Commodities Futures Exchange and Islamic financial products, real estate investment trusts (REITs), and Asset Backed Securities, and the growth enterprise market segment (GEMS) to enable SMEs raise long term funds through the NSE. Whether these reforms have improved the efficiency of the market remains unknown.

2.1 Efficiency of Securities Markets

Over the years, financial economics research has been mainly concerned with the speed at which information is incorporated into security prices. Information is a key driver of security prices and any new information is normally reflected by changes in the security prices. A market is said to be informally efficient if prices adjust rapidly to the arrival of new information and, therefore, the current prices reflect all information about the security (Reilly and Brown, 2011). New information, must by definition, and be unpredictable, since if it could be predictable then it would be part of today's information (Owido et al, 2013). Therefore, if information is unpredictable, security prices will move randomly and unpredictably, and will be unpredictable if security market is efficient.

Fama (1970) put structure on the concept of market efficiency by developing three versions of efficiency with respect to information available, that is, the weak form efficiency, the semi strong form efficiency and the strong form efficiency. The weak form efficiency asserts that current prices reflect all the past information on security prices. The semi-strong efficiency suggests that the current price of a security incorporates all public information. The semi-strong hypothesis incorporates the weak EMH (past prices) and public information such as earnings and dividend announcements. The semi strong efficiency states that security prices reflect all information, both public and private information (inside and secret information).

2.2 Studies on Weak Form Efficiency from Africa

Studies on weak form efficiency have been conducted on various securities markets across the continent. Generally, there is a disagreement on whether or not African markets are weak form efficient. For instance, Simon and Laryea (2004) examined the weak form market efficiency in stock markets in South Africa, Ghana, Mauritius, and Egypt using parametric test (auto-correlation and variance ratio test) and non-parametric tests (runs test) and found only South Africa to be weak form efficient. On the contrary, Mlambo and Biekpe (2005) covered ten African stock markets using individual stocks data adjusting for thin trading and found markets in Kenya, Zimbabwe and Namibia to be weak form efficient, whereas those in Ghana, Mauritius, Egypt, Botswana, and BVRM were not.

Similarly, Ntim et al. (2007) examined the weak form efficiency in the Ghana Stock Exchange using robust test (Variance ratio test) and found it to be was weak form inefficient. This is in line with the findings reported by Mlambo and Biekpe (2005) but contrary to that by Simon and Laryea (2004). Additionally, Kalu (2008) found that the returns at the Nigeria Stock Exchange (NiSE) are not normally distributed and do not follow a random walk. In contrast, Okpara (2010) using data from the all share index and a series of runs test and autocorrelation test concluded that the NiSE was weak form efficient.

Available evidence from the Nairobi Securities Exchange is also mixed. For instance, using runs tests and autocorrelation test, Dickinson and Muragu (1994) examined the weak form efficiency of the NSE from 1979-

1989 using a sample of 30 stocks and found the NSE to be weak form efficient. Mlambo and Biekpe (2005) and Magnusson and Wydick (2002) also found the NSE to be weak form efficient. In addition, Rioba (2003) examined the predictability of stock returns in the NSE and found weak evidence of predictability which implies that the market is weak form efficient. On the contrary, Parkinson (1987) and Jefferis and Smith (2005) have found the NSE to be weak form inefficient. On the other hand, Onyuma (2009) found presence of the day-of-the-week and month-of-the-year effects at the NSE, while Mokua (2003) found no evidence of the weekend effect at the NSE. Finally, Atiti (2005) found that it was possible to generate abnormal returns in the NSE by using momentum strategies. These studies provide evidence for and against the weak form of efficiency.

2.3 Evolving and Adaptive Market Efficiency

Besides the mixed efficiency results of the studies above, most of them have resulted in testing whether markets are weak form efficient or not. It is unlikely that with changes in the market environment such as the introduction of institutional and foreign investors, change in trading system and regulatory changes, the efficiency of a market would remain static from period to period.

In order to assess the impact of environmental factors on market efficiency, a number of studies have recently emerged which examine how the weak form efficiency changes over time. For example, Jefferis and Smith (2005) tested for changing efficiency in seven African stock markets using a GARCH model from 1990-2001 and found that the South Africa market was weak form efficient in the entire period, while Egypt, Morocco and Nigeria markets were weak form inefficient at the start of the period but approached weak form efficiency towards the end of the period. Mauritius, Zimbabwe and Kenya were weak form inefficient in the entire period. This may be due to the fact that most of these Africa stock markets suffer from low liquidity and size when initially set up, but as they grow in liquidity they become more efficient.

Similarly, Kalu (2009) examined the weak form efficiency on various time periods in the Nigeria using runs tests and found evidence that the market was weak form inefficient in the entire period of 1985-2007. However, there was a significant improvement in efficiency from 2000 to 2007 due to legal reforms undertaken. On the contrary, Abdmoulah (2009) tested for evolving efficiency in eleven Arab stock markets using a GARCH-M model and found that none of these markets showed a clear trend towards more efficiency despite the numerous reforms undertaken to improve the size and liquidity. Also, Alam et al (2011) found that despite the numerous policy reforms undertaken at the Dhaka Stock Exchange the market was still inefficient in the weak form.

Further, Lim and Brooks (2006) using rolling bi-correlation tests, tested for weak form efficiency in developed and emerging markets and found that market efficiency undergoes cycle's overtime and provide a case for the adaptive market efficiency (AME). Similar findings were also reported after studying the daily and weekly return predictability of DJIA from 1900-2009 using auto-correlation tests – the variance ratio and portmanteau tests. Return predictability was driven by changing market conditions. During market crashes, there was no return predictability but an extreme degree of uncertainty of returns. However, during economic or political crises, stock returns were highly predictable with moderate degree of uncertainty, whereas during bubbles, return predictability and uncertainty was smaller than normal times.

2.3.1 Environmental Factors and Adaptive Market Efficiency

In view of the differences that exist between classical EMT and behavioural finance, the AME was developed with an attempt to reconcile the two by adopting an evolutionary approach – competition, adaptation and natural selection. AME argues that market returns may be influenced by factors within the market environment such as competition amongst intermediaries, changes in market microstructure, fiscal and monetary reform, etc. (Lo, 2004). Therefore, market efficiency is not an all-or-none condition but is a characteristic that varies continuously over time and across markets (Lo, 2005).

Several studies have assessed the effect of such environmental factors on market returns. For instance, Mensah (2004) argue that the liquidity of a market and the behaviour of security prices are affected by a myriad of factors, both macrostructure and microstructure. Macro-structural factors are those factors beyond the control of market authorities and affect the number and types of market participants and their expectations equally, and include sovereign risk, fiscal and monetary policies and legislations.

Institution microstructure factors can be controlled by market authorities and have a direct effect on the market structure. They include product design (credit risk, maturity, use of derivatives), market participants (types of issuers and buyers), trading systems (call trading or continuous trading, dealer markets, manual or automated trading), clearing and settlement system mechanism (payment systems, clearing and settlement) (Okumu, 2013; Onyuma and Okumu, 2014), and regulatory and accounting framework (accounting system, taxation). Although

market authorities can use a combination of these tools to enhance liquidity and improve market efficiency, the most direct factor under the control of market authorities is the trading mechanisms, which affect the price formation process and generally linked with the market efficiency. With market integration, market efficiency should improve with the introduction of foreign investors. However, empirical evidence on the impact of foreign investor participation on stock market efficiency is rather inconclusive. For instance, Fuss (2005) found evidence of improved market efficiency in seven Asian markets in India, Indonesia, South Korea, Malaysia, the Philippines, Taiwan and Thailand after allowing for foreign participation. On the contrary, Kawatsu and Morey (1999) using data from emerging markets in Argentina, Brazil, Chile, Colombia, India, Korea, Mexico, Thailand, and Venezuela reported that the introduction of foreign investors had no impact on the weak-form efficiency of these markets. This evidence has been corroborated by Laopodis (2003) in Athens Stock Exchange.

The trading system plays an important role in the price discovery process of a market. The bulk of the evidence points towards improved efficiency after introduction of the computer based trading. For example, Sinnakkannu and Nassir (2006) found that microstructural changes captured by introduction of ATS and CDS by Bursa Malaysia reduced the time to equilibrium – speed for information adjustment from 14 days to 9 days in 2001. Evidence of increased efficiency following after microstructure changes have been found at the Italian Stock Exchange (Majnoni and Massa, 2001), Tel Aviv Stock Exchange (Amihud et al., 1997) as stocks that were selected for transfer from the call auction system to the continuous trading system posted positive gains due to liquidity improvements. Furthermore, Olujide (2000) found evidence that the automation of the Nigerian market in 1997 had a positive impact on the liquidity of the market, transparency, investor confidence and foreign investment. However, Debysigh and Watson (2007) found that the Jamaican, Trinidad and Tobago stock markets were informational inefficient both before and after automation of their trading systems.

Empirical evidence further shows that increased trading hours in at the Indian stock market increased trading volume and liquidity, reduced the volatility of returns, and increased foreign institutional investor participation (Argawal and Chauhan, 2010). Institutional investors play the role of arbitrageurs while providing market liquidity. The introduction of institutional investors has been associated with improved market efficiency. Chen et al (2004) document that an increase in institutional investors in the NYSE, AMEX and NASDAQ significantly reduced the Monday-effect and that stock with high institutional ownership had a low Monday-effect. Similarly, Bohl et al (2006) found that the January effect in Hungary and Poland significantly reduced after pension reforms allowed institutional investors to invest in the market.

3. Research Methodology

3.1 Data Type and Data Collection

The NSE-20 Share index is a value weighted index consisting of the 20 most actively traded companies from the various market segments, and is widely used to tracks the daily performance of Kenyan market. The Index data was collected and divided into two sub samples representing two periods: pre-reform (July 1997 – December 2001) and post-reform (January 2007 – July 2011). Monthly Index data was obtained from the NSE. The use of monthly data overcomes the problems associated with thin trading (Kalu, 2008).

3.2 Computation of Market Returns

The monthly Index return was computed as the first difference of the logarithmic price index (equation 3.1), and use of logarithms assumes that returns are more likely to be normally distributed (Simons and Laryea, 2004).

$$\mathbf{R_t = InP_t - InP_{t-1}} \qquad 3.1$$

R_t = Monthly returns for NSE 20 Share Index for period *t*
P_t= NSE 20-share index value for month *t*.
P_{t-1} = NSE 20-share index value for month *t-1*.
In= Natural Logarithm.

3.3 Tests of Normality

The random walk hypothesizes that in an efficient market, successive residual increments follow a normal distribution (Kalu, 2009). Thus, normality tests were carried out using skewness, kurtosis and Ryan Joiner test (Shapiro-Wilk). These measures have been widely used in other studies (Okpara, 2010; Jefferis and Smith, 2005).

3.4 Test of the Effect of Reforms on market Efficiency

To determine whether the introduction of market reforms had an effect on the price discovery process, Wilcoxon signed rank test – a non-parametric test equivalent to the paired T- test was used. The null hypothesis was that the median returns earned before market reforms was not significantly different from the median returns after market reforms. Failure to reject the null hypothesis would mean that market reforms had no effect on the price discovery process. Levene's test is an equivalent of the F-test and is used to measure equality of variances. This test was used to determine whether price volatility has reduced in the post-reform period.

3.5 Test of Weak Form Efficiency

Runs tests have been extensively used to test for serial independence of stock returns and to infer on weak form efficiency (Mlambo and Biekpe, 2005; Okpara, 2010). This test can uncover the random walk as it disregards the properties of distribution. The test determines whether successive price changes are independent of each other. A series of runs is said to follow a random walk if successive price changes are independent. If a series of runs does not follow a random walk, the null hypothesis is rejected. To determine whether a series is random, the expected number of runs is compared with the observed number of runs. In a random series the observed number of runs is closer to the expected number of runs. If the observed number of runs is fewer than the expected number of runs then the series may have positive autocorrelation. If the observed runs are more than the expected runs this may indicate negative autocorrelation. Thus, too few runs or too many runs indicate evidence against the random walk (Reilly and Brown, 2011).

4. Results and Discussion

4.1 Descriptive Statistics

The mean return in the post reform period (Table 1) was higher than mean return in the pre reform period, while the median return in the post reform period was higher than the median returns in the pre reform period. The standard deviation in the post reform period was also higher than the standard deviation in the pre reform period. The higher median return and standard deviation reported in the post reform were tested for significance in the next section.

In order to test if returns follow a normal distribution, the skewness, kurtosis and Ryan-Joiner tests were used and the results of these tests are presented in Table 1**.** Results show likely departure from normality in both periods as none have a skewness value equal 0 and kurtosis value equal to 3. The returns in the pre reform period are positively skewed and leptokurtic, an indication that returns in the pre reform have a long right tail and slightly peaked. The returns in the post reform period are negatively skewed and platykurtic indicating that the returns have a long left tail with a relatively flat peak. The negative skewness value in the post reform period shows a greater chance of extreme negative values while the positive skewness value in the pre reform period imply a lesser chance of extreme negative values. The result should not be surprising taking into account that the NSE was adversely affected by the global financial crisis in 2008 and the price volatility may have resulted from the launch of securities depository system (Okumu, 2013).

A test for normal distribution was also conducted using the Ryan-Joiner test. From Table 3, the p values for the Ryan-Joiner test for both sub periods are less than 0.01. This means at 5% significance, the null hypothesis of normal distribution was rejected for both periods. This test confirms the earlier finding that returns in the pre and post reform periods are not normally distributed. Although it would have been expected that returns after reforms to closely approximate a normal distribution, the results confirm that returns in the NSE exhibit stylized facts (Opong et al, 2010), returns distributions which have fat-tails, skewed, experience volatility clustering and long memory.

4.2 Impact of Reforms on Price Discovery Process

An efficient price discovery process ensures that investors realise the best prices for their stocks which should ideally be closer to the fundamental values. The introduction of market reforms was expected to improve on the efficiency of price discovery process by targeting liquidity and transparency among other factors. Therefore, if reforms have had a positive effect on the price discovery process, investors would lower their required rate of return due to increased liquidity and transparency and in turn prices should appreciate. In other words, the returns earned in the post reform period would be higher than returns earned in the pre reform period. To test whether reforms had a positive effect on the price discovery process, the Wilcoxon signed rank test was used with the results presented in Table 2.

The results show a p-value of 0.037 while the alpha level for the test was 0.05. The p-value was less than the alpha level for the test. Thus, at 5% significant level we reject the null hypothesis and conclude that returns earned in the post reform period were higher than the returns earned in the pre reform period. The implication is that introduction of market reforms had a positive impact on the price discovery process, and corroborates findings by Amihud et al, 1997; Sinnakkannu and Nassir, 2006).

4.3 Impact of Reforms on Market Volatility

In an efficient market, stock prices approximate their fundamental values, with less volatility. However, excess market volatility leads to price distortions and market prices may not reflect the fundamental values. Introduction of market reforms by market authorities are meant to ensure that market prices closely approximate fundamental prices and aimed at improving liquidity and transparency, thus enhancing market efficiency. To test whether reforms led to reduced volatility, the Levene's test was used. The test uses the median value in testing for equality of variances and is appropriate where data is not normally distributed and. A one tailed T-test was carried out at 5 percent significance level. The results of the test are presented in Table 3.

The results show a p-value of 0.996 with a test alpha level of 0.05. Thus, at 5 percent significance level we accept the null hypothesis, implying that price volatility in the post reform period did not reduce, as there was higher volatility in the post reform period than in the pre reform period. In fact, a lower standard deviation would have been expected in the post reform period especially due to increase in liquidity, transparency and the number of market players. The higher volatility in the post reform period could be attributed to the changes in the trading system, as other studies (Chang et al, 1998) have also linked price volatility with continuous auction markets than call markets due to trading frequency, associated with increased speed at which information reaches the market causing prices to fluctuate rapidly as they converge towards equilibrium (Naidu and Rozeff, 1994).

4.4 Test of Market Efficiency

To test whether market reforms resulted into improved market efficiency, runs test was used to assess the efficiency of the market in the pre-reform and post reform periods. If reforms have improved market efficiency then the speed at which information is incorporated in prices should increase and so returns should be more random. The runs test results for the pre reform period (Table 4) shows that the observed number of runs was 24 while the expected number of runs was 28. The observed number of runs was closer to the expected runs which imply randomness in the series. Additionally, the runs test results displayed a p-value of 0.272 which was greater than the test alpha level of 0.05. This implied that the returns in the pre-reform period follow a random walk.

Results of runs test for the post reform period (Table 5) shows that the observed number of runs was 26 while the expected number of runs was 28. The observed numbers of runs are also closer to the expected numbers of runs implying randomness of returns. Similarly, the p-value for the post reform period was 0.583 which was greater than the test alpha level of 0.05, implying that the returns in the post reform period were also random. But the number of observed runs in the post reform period was much closer to the expected number of runs than those during pre-reform period. Even the post reform p-value of 0.583 was higher than that for pre reform of 0.272, reaffirming that returns were more random in the post reform period – an indication of improved efficiency. These findings are in line with Maghyereh (2005), Kariuki (2012) and Kariuki and Onyuma (2012).

5. Conclusions and Recommendations for Policy

This study found the post reform period posted a higher mean return than the pre reform even though with higher volatility. The higher mean return in the post reform period was as a result of an improved price discovery process while the increased volatility could be due to changes in the introduction of the securities depository system. Although it would have been expected that the post reform period would have closely approximated a normal distribution, the results indicate that returns in both periods did not follow a normal distribution. Additionally, the study found that there was improved efficiency in the post reform period. Usually, when a market first starts trading, it takes time for the price discovery process to become known. As the market continues in operation and market microstructures and regulations develop, emerging stock markets are likely to improve in efficient. The changing efficiency in the two periods therefore provides support for the adaptive market hypothesis. Generally, we have shown that market reforms carried out at the NSE have improved the efficiency of the market.

To further improve the market efficiency at the NSE, the CMA and the NSE should consider licensing more market makers to assist in improving liquidity. The NSE operates as a continuous limit order market where brokers receive potential buy/sell orders that are submitted in an electronic system for matching. This system

suffers from lack of immediacy, which may result to order imbalances leading to large price changes primarily because there is nobody who stands ready to buy or sell. The adoption of a mixed trading system to improve market liquidity would also suffice since other markets such those in Taiwan and Tunisia have both a call and continuous system, which is more effective when dealing with thinly traded stocks while the continuous system is suited for heavily traded stocks. In Tunisian, the market opens with the call system and then changes to a continuous system for liquid stocks. Lastly, reforms in the ownership and management structures of the NSE could also improve transparency and market confidence. Therefore, the regulator and the exchange should fast track the completion of the demutualization process. Such reforms could aid in bolstering market confidence as well as increase market activity, which are necessary in improving market efficiency.

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Table 1: Results of Descriptive Analysis

Variable	Pre reform	Post reform
Mean	-0.01773	-0.00653
StdDev	0.03950	0.07128
Median	-0.01838	0.00479
Skewness	1.04	-1.02
Kurtosis	3.52	2.80
RJ	0.960	0.962
RJ (p-value)	< 0.01	< 0.01

Table 2: Results of the effect of reforms on Returns

Test of median = 0.000 versus median > 0.000					
	N	N for Test	Wilcoxon Statistic	P	Estimated Median
Diff(Post -Pre)	54	54	951.0	0.037	0.01649

Table 3: Results of the effect of reforms on volatility

Null hypothesis Variance(Post reform) / Variance(Pre reform) = 1				
Alternative hypothesis Variance(Post reform) / Variance(Pre reform) < 1				
Significance level Alpha = 0.05				
Test				
Method	DF1	DF2	Statistic	P-Value
F Test (normal)	53	53	3.26	1.000
Levene's Test (any continuous)	1	106	7.44	0.996

Table 4: Results of Run test for the Pre reform Period

Runs above and below K = -0.01838
The observed number of runs = 24
The expected number of runs = 28
27 observations above K, 27 below
P-value = 0.272

Table 5: Results of Runs Test for the Post Reform Period

Runs above and below K = 0.00479
The observed number of runs = 26
The expected number of runs = 28
27 observations above K, 27 below
P-value = 0.583

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