



Investigating the suitability of introducing Index Funds in Kenya

VK Nyauncho

 orcid.org/0000-0002-8484-8433

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Promoter: Prof WS Musvoto

Co-Promoter: Dr E Sonono

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Student number: 28209818

SCHOOL OF BUSINESS
FACULTY OF ECONOMICS AND MANAGEMENT SCIENCES

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Declaration

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Abstract

The purpose of this study was to investigate the suitability of introducing index funds in the Kenyan capital markets and to formulate a framework for the introduction of index funds. Therefore, the study set out to achieve two objectives: to assess the weak form Efficient Market Hypothesis (EMH) for the Nairobi Securities Exchange (NSE), and to determine whether the current Nairobi Securities Exchange (NSE) stock indices are representative of the Kenyan capital market.

These issues emanate from a general problem within the Kenyan capital markets, namely the use of active management strategies that are characterised by hefty management fees as well as other fees. These hefty fees have a negative impact on returns. Index funds are a solution to this problem, because the funds are low in cost and mimic a benchmark index. However, the specific problem is that it is not clear whether factors that are required for the introduction of index funds are in place. Index funds require an informationally efficient market, a market representative index, and an adequate regulatory framework. To this end, the present study sought to address the two objectives mentioned above.

The study was carried out from a post-positivism stance, hence the research was a quantitative approach that adopted a correlational design in which timeseries data from the Nairobi Stock Exchange (NSE) was utilised. To achieve the first objective; the serial (auto) correlation test and the variance ratio tests were employed. The linear unit root tests which comprise of the Augmented Dickey-Fuller test, the Philip Perron's test, and the Zivot Andrews test, were implemented. The runs test was also applied as a confirmatory test. Nonlinear unit root models were also implemented. These comprised of the two regime and the three-regime threshold autoregressive (TAR) tests. Lastly, the Pairwise Granger causality test was applied to test the market representation of the stock indices.

The empirical results indicated that the NSE is weak-form inefficient and hence index funds cannot be introduced into the NSE because the Bourse violates the Efficient Market Hypothesis (EMH). On the other hand, three of these indices are representative of the Kenyan capital markets. Thus, index funds can mimic the three indices and be introduced into the market. Based on these results, the framework for the introduction of index funds was formulated. The framework indicated policy suggestions that would enhance informational efficiency within the capital market enabling introduction of index funds.

Key terms

Index funds, Efficient Market Hypothesis (EMH), Nairobi Stock Exchange (NSE), passive funds, active funds, African Exchange markets (AEMs), Linear and nonlinear Unit root tests.

Acronyms

ACVF	Auto-covariance Function
ACF	Autocorrelation Function
ADF	Augmented Dickey Fuller
AELP	African Exchanges Linkages Project
ATS	Automated trading system
AFM	Association of Futures Market
AEMs	African Equity Markets
AIC	Akaike information criteria
AIMS	Alternative Investment Market Segment
ASEA	African Securities Exchanges Association
AR	Autoregressive
ARMA	Autoregressive Moving Average
ASPI	All Share Price Index
AUM	Assets Under Management
BRVM	Bourse Regionale des Valuers Mobiliers
BIC	Schwarz-Bayesian information criterion
BSD	Bank Supervision Department
BSE	Botswana Stock Exchange
BVMAC	Bourse des Valeurs Mobieres Centrale
CBK	Central Bank of Kenya
CDS	Central Depository System
CIC	Capital Issue Committee
CHU	Complaint Handling Unit
CMA	Capital Markets Authority
COSSE	Committee of SADC Stock Exchange
COOP	Co-operative
DGP	Data Generating Process
ETF	Exchange traded funds
EMH	Efficient Market Hypothesis
FTSE	Financial Times Stock Exchange Group

FIMS	Fixed Income Market Segment
FISD	Financial Information Services Division
GDP	Gross Domestic Product
GEMS	Growth Enterprise Market Segment
IMF	International Monetary Fund
IPO	Initial Public Offer
I-REIT	Income Real Estate Investment Trust
D-REIT	Dividend Real Estate Investment Trust
JSE	Johannesburg Security Exchange
KRX	Korean Stock Exchange
KWFT	Kenya Women Microfinance Bank (KWFT)
MA	Moving Average
MENA	Middle Eastern & Northern African
MFBs	Micro Finance Banks
MSMEs	Micro Small and Medium Enterprises
MIMS	Main Investment Market Segment
MPT	Modern Portfolio Theory
FIMS	Fixed Income Market Segment
MPT	Modern Portfolio Theory
NASI	Nairobi Securities Exchange All Share Index
NAV	Net Asset Value
NCBA	National Commercial Bank of Africa
PACF	Partial Autocorrelation Function
PP	Phillips Perron
NSE	Nairobi Securities Exchange
NSE	Nigerian Stock Market
NSM	Namibian Stock Market
NTFML	National Task Force on Money Laundry
RWH	Random Walk Hypothesis
SACCO	Savings and Credit Cooperative Societies
SASRA	SACCO Societies Regulatory Authority
SADC	South African Development Community
SAE	South African Exchange

SSE	Somalia Stock Exchange
SIIA	Software and Information Industry Association
TSE	Tanzanian Stock Exchange
UIT	Unit Invested Trusts
USP	Unquoted Securities Platform
UNDP	United Nations Development Programs
WAEMU	West African Economic and Monetary Union
WACMIC	West African Capital Markets Integration Council

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CHAPTER 1

Introduction to the study

1.1 Introduction to the background of the study

The purpose of this study is to investigate the suitability of introducing index funds in Kenyan capital markets and formulate a framework for the introduction of index funds. This is because the general problem of the Kenyan capital markets is that fund managers utilize active fund management strategies that are costly to the investor. These strategies could either be fundamental or technical analysis. Furthermore, hefty fees are charged by active fund managers who implement these strategies. These hefty fees translate to lower returns for investors in the long term as compared to returns from a passive benchmark.

Index funds that are low cost can resolve this problem if introduced to the Kenyan capital markets. Index funds, however, require an informationally efficient capital market where prices of securities reflect available information, both historically speaking and also with regard to current information. In this kind of informational efficient market, prices adjust quickly to new information. Therefore, it is not possible for active managers to beat a passive benchmark index and earn excess returns. In cases where active managers have managed to beat the market it has been found that it is not possible to repeat the performance in an efficient market.

The underlying theoretical point of departure of this study is therefore the Efficient Market Hypothesis (EMH). It is not clear whether the Kenyan Capital market follows the Efficient Market Hypothesis or violates the Hypothesis. The study therefore sought to assess the weak form of Efficient Market Hypothesis (EMH). Index funds also require a market representative index, because the funds mimic a given securities' index. The securities' index could be a bond index, equity index or a commodity index. It has also not been confirmed whether securities in the NSE are market representative or not. Therefore, the study also sought to determine whether the current NSE stock indices are indeed representative of the Kenyan capital markets.

This study argues that index funds are needed in Kenya because of the benefits that they offer. Index funds are passively managed investment funds that mimic a specific securities index. These funds are traded in capital markets. Index funds offer investors an opportunity to pool funds for the sake of

investments. This gives retail investors with minimal amount of funds an opportunity to investment. Secondly, index funds are passively managed. This means that fund managers applying this kind of management strategy hold securities so that returns arising from the investment can match a passive benchmark. Because passive investment strategies are being utilised, these are low cost. This might be one of the most important benefits of index funds because this eventually translates to higher returns for the investor in the long run. Finally, index funds mimic a securities' index. This means that the fund manager can choose to invest in all the securities that constitute an index, or a sample of securities of the index. This gives investors an opportunity of diversifying their investments and to manage risk.

In light of the discussion above, this introductory chapter presents the background to the study in section 1.2. Section 1.3 defines index funds, and Section 1.4 explains the factors required for the introduction of the index funds. The subsequent section presents the need for index funds in Kenya. This is followed by the problem statement in Section 1.6, and Section 1.7 outlines the research objectives, followed by Section 1.8 where a brief discussion of the contributions and benefits of the study are set out. Section 1.9 explains the scope and structure of the study and assumptions thereof are discussed in Section 1.10. Lastly, Section 1.11 presents the chapter outline.

1.2 Background to the study

The Kenyan Financial sector is a large sector that is made up of many components, including institutions that are deposit-taking and non-deposit-taking institutions. Sasra (2020) categorises these institutions as follows: The deposit-taking institutions comprise of Commercial Banks, the Mortgage Refinance Companies, and the Microfinance Banks. The deposit-taking SACCOs (DT-SACCOs) are also part of the sector and the Regulated Non-withdrawable deposit Taking SACCOs. The non-deposit taking institutions consist of the Insurance, Pensions; and Capital Markets sectors. The Regulatory bodies of the financial sector are also part of the financial sector. These are the Central Bank of Kenya (CBK); the Sacco Societies' Regulatory Authority (SASRA); Retirement Benefits Authority (RBA); Insurance Regulatory Authority (IRA); Capital Market Authority (CMA) and other Government Ministries. Finally, the financial market infrastructure is also part of the financial sector. The infrastructure is an interconnected system that includes Fin-Tech, which enables payments, settlement and custodial services and international operations. Informal finance providers are also part of the financial sector (Sasra, 2020).

One of the institutions that make up the financial sector is the banking sector. The banking sector in Kenya is a well-organised sector that comprises a number of institutions that are regulated by the Commercial Bank of Kenya (CBK). The CBK bank supervision report (2020) states that these institutions include public and private banking institutions, non-operating bank holding companies, Micro Finance Banks (MFBs), Credit Reference Bureaus (CRBs), Money Remittance Providers (MRPs), Foreign Bank Representative offices, Mortgage Refinance Company, and Foreign Banks Representative offices. The existence of these institutions and a regulatory body implies that there are laws and regulations governing the sector. The CBK bank supervision report (2019) states that the sector operates under the Central Bank Act (Cap 491).

The banking sector is a growing sector, and this has been indicated by positive increment in the capital reserves, total assets and general deposits within the banking sector. CBK (2019) notes that between 2019 and 2020, capital reserves in the sector increased by 10.8 % and total assets indicated a growth of 12.4%. All sectors' peer groups registered increased capital and reserves (CBK, 2019:7). The microfinance banks have historically been very beneficial to Kenyans, and they have experienced tremendous growth over the years. Financial sector regulators (2011) and CBK (2019) explain the growth by indicating that the number of the MFBs increased from five banks in 2010 to fourteen by December 2020, and the number of branches country wide increased from 118 in 2019 to 123 in 2022. This leads one to believe there is great potential within the financial sector, and Kenyans are in a position to utilise and take advantage of the banking sector institutions.

The banking sector has also been revolutionised by technology and especially mobile phone technology. These have brought about inclusiveness to many Kenyans in the financial system. The Commercial Bank of Kenya (2015) recognizes that the sector has become highly innovative and integrated. Indeed, mobile phone technology has changed the financial sector completely, with banks utilising the technology to become more marketable to customers and include more Kenyans in the banking system. The banking sector has become the second most sophisticated after South Africa, but the first in leveraging technology and mobile solutions in Africa.

The second component of financial sector is Saccos. These institutions began in the colonial era, mostly as farmers' cooperatives. The cooperatives evolved to Saccos in the post-colonial era, and there was an

increase in the number of Saccos. It is, however, noted that the Saccos have decreased in numbers in the recent past. Sasra (2011) reported that that 50% of cooperatives in 2010 were registered as Saccos and the total number of registered Saccos at that time was 6,737. However, Sasra (2020) reported that as at the beginning of the year 2020, Sasra, the Regulatory Authority of Saccos had issued deposit-taking licenses to 173 deposit-taking Saccos in the country.

These figures demonstrate a significant decline in the number of Saccos in Kenya. This could imply a number of issues, including stiff competition from other deposit-taking institutions. Despite this decline in the number of Saccos, there has been significant increase in growth indicators such as total assets, share capital and turnover. The number of members in Saccos has also increased. Sasra (2010) showed that the total assets for the years 2006 to 2010 increased by 52% in terms of millions. By 2020, the assets had increased to Kes. 431.46 billion (Sasra, 2020). The total deposits increased by 141% between 2006 and 2010 (Sasra, 2010). By 2020, deposits were Kes. 431.46 billion (Sasra, 2020). The share capital increased for the years 2006 to 2010 from Kes. (in millions) from 2 030, to 5 413 respectively. In 2020, the share capital had increased to Kes. 115.28 billion (Sasra, 2020).

The insurance sector, which is a key part of the financial markets, is made up of a number of components. Financial regulators (2011) list the components that constitute the insurance sector as the re-insurance companies, insurance companies, insurance brokers, medical insurance providers, insurance agents, loss assessors, insurance investigators, loss adjusters, surveyors and claims settlement agents. The insurance sector has equally grown and developed over the years, with the regulatory framework experiencing reforms. Financial regulators (2019) mention that Gross Direct premiums have increased between 2015 and 2018, and the development of the regulatory framework with amendments of the Insurance Act is being pursued.

Capital market as part of the financial sector is made up of different institutions that operate either at the primary markets or at the secondary markets. According to the CMA Annual report (2021), these institutions comprise the Central Depositories, Securities Exchanges, Credit Rating Agencies, Authorized Securities Dealers, Authorised Depositories, Investment Banks, Fund Managers, Stock Brokers, Investment Advisers, REIT Managers, REIT Trustees, Authorised REITS, Registered

Collective Investment Schemes, Registered Employee Share Ownership Plans (ESOP), Non-Dealing Online Foreign Exchange Brokers, a Money Manager, a Coffee Exchange, and Coffee Brokers.

Primary and secondary markets have shown growth over the years. The existing primary markets have issued equity issues, rights issues, stock splits, bonus issues, corporate bonds, and treasury bonds in the recent past. According to the CMA (2021), data from trading of these products has indicated growth in the primary markets for the period between 2007 and 2021. Existing secondary markets have also grown over the years. This has been indicated by the CMA's (2020) Kenya Financial sector report, where data on the share volume traded shows steady growth between 2006 and 2010. Market capitalisation has also increased in the same period. Equity turnover and the bond turnover have shown improvement between the periods of 2006 to 2010. In addition, there has been a positive percentage change that was experienced for the years 2020/2021 for the equity turnover, share volume, market capitalisation and bond turnover. It follows that both the primary and secondary markets in Kenya are maturing, and are ready to accommodate more products that will deepen the markets and meet investors' needs.

Moreover, the capital markets and money markets have seen more and more institutional and retail investors take part in investment activities in the markets. The Capital Markets Authority (2018) reports that assets under management in collective investment schemes have had a positive growth from Ksh. 20 billion in 2013 to Ksh. 57 billion in 2017, with money market funds being the most popular. This proves that there is a willingness and potential amongst the Kenyan investors to invest in collective investment funds. The funds are becoming more popular, and suggest the need to introduce more products that can be offered to investors through collective investment schemes (CIS). The Central Bank of Kenya (2015) adds that in terms of the extent of US investments in capital markets, Kenya has become the second largest player after Egypt.

The CMA has been at the forefront in the development of new products, and it has utilised relevant technology to achieve this. Indeed, the Kenyan Capital Markets Authority has been voted as the most innovative market regulator in Africa. The Oxford Business Group (2016) pointed out that in 2016 the stock exchange launched the Derivatives market, Exchange Traded Funds (ETFs), and a mobile-based retail bond known as the "M-Akiba bond" which was unique to the Kenyan capital market. This proves that Kenya is one of the leaders in Africa in capital markets innovations. Furthermore, the CMA (2021: 114) states that, "the CMA joined 23 regulators across five continents to test innovative financial

products, services, business models and regulatory technology in November 2021” (CMA, 2021:114). These statements justify the notion that if conditions for the introduction of index funds in Kenya were to be in place, the CMA could consider the introduction of the same.

The financial sector in Kenya has also grown and has had significant achievements. It has also become one of the leading financial sectors in the East African region. The Oxford Business Group, (2016) reports that, between 2013 and 2018, Kenya’s financial sector had become the third largest in Sub-Saharan Africa with continued reforms in regulations within the sector being undertaken. To this end, the Finance Act, the Capital Markets Act, and the New Companies Act have been passed. Also, both the money markets and the capital markets offer a variety of financial instruments to their users through innovations made through the Capital Markets Authority.

However, despite these developments in the financial sector, there is room for more advancements, especially in the capital markets – and specifically through the introduction of new financial instruments. This will deepen the capital markets. Index funds as a financial investment vehicle that are traded in capital markets are not found in the Kenyan financial markets. These funds can be introduced into the financial markets. For a more profound understanding of index funds, the sub-section below explains index funds.

1.3 Defining index funds

Index funds are pooled funds that are passively managed. This kind of management strategy is low cost, and funds are pooled for the purpose of investments. Cornett and Saunders (2009) define index funds as mutual funds that are long-term in nature and are designed to match the performance of a stock index. The term mutual funds indicate a common purpose of the funds. Cornett and Saunders (2009) define mutual funds as financial intermediaries that collect investment funds in one pool and invest the funds in portfolios of assets, enabling small investors to invest in liquid and diversified portfolios of financial assets. This leads one to believe that small investors have an opportunity to create wealth through these funds while managing risk through diversification. In addition, Cornett and Saunders (2009) purport that mutual funds are more established in the United States and they have been the fastest-growing sector in the United States. The funds have increased by 115 percent between 1992 to 2007 and the number of mutual funds worldwide has increased by 208 percent within the same period. Between the periods of 1992 to 2007, mutual funds’ investments worldwide have increased by 755 percent from \$1.626 trillion

in 1992 to \$ 13.902 trillion in 2007 (Cornett & Saunders, 2009). This suggests that mutual funds are attracting more interest worldwide and are becoming a popular investment vehicle.

There are two types of mutual funds: short-term and long-term funds, and these are traded in different markets. Block et al. (2009) and Cornett and Saunders (2009) explain that short-term funds are traded in the short-term markets also known as the money markets, where securities with maturities of less than one year are traded. On the other hand, long-term funds are traded in the long-term markets also known as capital markets, where securities of more than one year are traded. Furthermore, index funds are mutual funds that are long-term in nature and are designed to replicate the performance of a stock index. A further definition of index funds is given by Brown and Reilly (2009). Saunders and Cornett (2009) and Bodie et al. (2010) who concur that these funds are also known as passive funds. Such funds are capital markets' financial instrument that match or replicate the performance of a stock index whereby fund managers buy securities that are the exact composition of a stock index or invest in a sample of stock that mimic the stock index. It may be inferred from this that, for an index fund to be formulated, a market representative index that measures and represents market performance must be in place.

The term passive fund is derived from the passivity of fund management style used in index funds management. As discussed earlier passive fund management tends to be low cost. Various authors (Saunders and Cornett, 2009; Rothwell 2016; Chung et al., 2017; Gokcen and Yalcin, 2015) concur that index funds are characterised by passive management strategies, and thus have lower management fees as compared to active funds. These funds tend to yield higher returns and are diversified in nature, therefore lowering investors' risk. It can be assumed that a risk-averse investor may well choose to invest in index funds due to their obvious advantages.

Brown and Reilly (2009) define passive management strategies as those that hold securities so that portfolio returns match those of a benchmark index over time, generally referred to as indexing. On the other hand, active fund management is defined as an attempt by a fund manager to outperform, on a risk-adjusted basis, a passive benchmark index. Consequently, active management strategies involve analysts who typically apply technical analysis or fundamental analysis to beat the market and as a result demand higher fees for their expertise. Brown and Reilly (2009) note that the goal of an actively managed portfolio is to earn a portfolio return that exceeds the return of a passive benchmark index, net of

transaction costs, on a risk-adjusted basis through beating the market. Clearly, that active and passive strategies are different, because one strategy tries to match a passive benchmark index while the other tries to outperform a passive benchmark index. Outperforming a benchmark index is commonly known as beating the market. Reilly and Brown (1997) add that beating the market has been criticised over the years as being virtually impossible in an efficient market, but others have argued that with superior analysts beating the market is indeed possible.

It may be deduced from these discussions that index funds are collective funds that are traded in the capital markets; are long-term in nature, and are also known as passive funds that are characterised by passive fund management strategies. In other words, the funds do not require technical and fundamental analysis offered by active managers in fund management, resulting in low-cost management fees and higher returns in the long run. The funds, in a sense, mimic the performance of a given stock index. Thus, this present study adapts a definition that (see Brown and Reilly, 2009; Cornett and Saunders, 2009; Bodie et al., 2010) index funds, also known as passive funds, are capital markets' financial instruments, that match or replicate the performance of a stock index, whereby fund managers buy securities that are the exact composition of a stock index or investing in a sample of stock that mimics the stock index.

1.4 Factors required for the introduction of index funds

In light of the above discussion, the underlying theory that supports index funds is the Efficient Markets Hypothesis (EMH). The Efficient Market Hypothesis holds that in an efficient market, new information is processed and evaluated as it arrives, and prices instantaneously adjust to new and correct levels. Consequently, an investor cannot consistently beat the market and earn excess returns by undertaking fundamental analysis or technical analysis (Kevin, 2009:124; Block & Hirt, 2002:416). This scenario is presuming that passive management strategies is the superior strategy in an efficient market. Various authors (Nyamute et al., 2013; Seth and Sharma, 2015; Chitenderu et al., 2014; Dragota and Tilica, 2013) note that index funds require the existence of an efficient market where there is a continued inability of active managers to beat the market. The theory suggests that, in an efficient market, active management of funds in the hope of outperforming the market is a futile endeavour. The theory further posits that instead, investors should invest in passively managed portfolios that outperform actively managed portfolios in the long run.

Adequate laws and regulations give confidence to participants in any sector. This also applies to the capital markets. An adequate regulatory framework within capital market brings about trust. Ojung'a et al. (2018:887), in their study on the effects of the growth of regulatory framework on the growth of mutual fund institutions, conclude that a sound regulatory framework had a significant positive influence on the growth of mutual funds. Adequate regulations encourage investors to participate more in mutual fund investments. Clearly, an adequate regulatory framework for the operation of index funds is required (Brown & Reilly, 2009; Kevin, 2009; Nagarajan & Jayabal, 2011; Saunders & Cornett, 2009). This study assumes that there is an adequate regulatory framework because of extensive regulatory reforms that have been done in the sector. To reiterate, a number of authors (PMC, 2017; Oxford Business Group, 2016) observe that during 2013 and 2018, Kenya's financial sector became the third largest in Sub-Saharan Africa with continued regulatory reforms within the sector being done. The Finance Act, Capital Markets Act and the New Companies Act that have been passed are testimony to this.

In conclusion, for index funds to be successful, a number of factors must be in place in capital markets. These are market efficiency, availability of a market representative stock index or bond index, and an adequate regulatory framework (Brown & Reilly, 2009; Kevin, 2009; Nagarajan & Jayabal, 2011; Saunders & Cornett, 2009). It is, at present, not clear whether the Kenyan capital market has all these factors in place for the introduction of index funds.

1.5 Need for index funds in Kenya

Mutual funds are known as Collective Investment Schemes (CIS) in Kenya. Similar to other mutual funds in other parts of the World, Collective Investment Schemes (CIS) have grown over the years and have attracted a number of investors. CMA (2018) comments that Collective Investment Schemes (CIS) amid low capital markets products uptake have registered immense growth, with assets under management in these schemes having experienced growth from Ksh. 20 billion in 2013 to Ksh. 57 billion in 2017.

It is noted that the main investment strategies utilised in these mutual funds are active investment strategies. The general problem with mutual funds in Kenya is the high cost associated with active investment strategies utilised to manage the funds. Akama and Jagongo (2013:199) point out that, "actively managed funds in Kenya have exhibited increased commission costs, transaction costs, and lower returns". In addition, Nyamute et al. (2015), note that active investment styles adopted by investors

in the NSE attracted hefty fees from managers and trading costs were higher, consequently, lowering the returns made on assets. It may be inferred from these statements that management fees, transactional costs and commission costs adversely affect investors returns and this is an issue that investors should approach with caution. It should be noted that Akama and Jagongo (2013) also found that fund managers' fees could not be compensated by the incremental returns accruing from their management skills and that they cannot consistently beat the market. In other words, management fees affect returns negatively. Osano (2013), in his study on the effect of investment strategies on the financial performance of investment funds in Kenya, found that the majority of the investment fund managers utilised active investment strategies. Likewise, Kirumba (2012) found ten out of sixteen fund management firms utilised active management strategies, and only six utilised passive investment strategies. Akama and Jagongo (2013) add that active management strategies were favoured by fund managers in Kenya. In light of this, it can be presumed that active management strategies in Kenya favour fund managers more than the investors.

Active management strategies, as the name suggests, refer to strategies and situations where fund managers are actively involved in the management of a fund. The managers utilise strategies such as fundamental and technical analysis. Scholars (Reily and Brown, 1997; Robbins, 2014; Cuthbertson and Dirk, 2008) define active fund management strategies as attempts by fund managers to outperform, on a risk-adjusted basis, a passive benchmark portfolio. It follows that there must be a benchmark that performance is compared to. In addition, some authors (Elton & Gruber, 1997; Bodie et al., 2010) note that active investment strategies are characterised by high fund management fees due to the high cost associated with of financial analysts and similarly high transaction costs.

In addition, other studies done in Kenya and globally have recommended the utilisation of passive management strategies due to their less costly fees and better returns. Iregi and Okeyo (2017) recommend the use of passive strategies in the Kenyan capital markets because they are low cost as compared to active investment strategies. Kirumba (2011), before these scholars, also recommended the use of passive investment strategies as they yield better returns on assets and have superior profitability. These strategies may have the effect that investors would be more considered and conditions will be more favourable for them if passive funds are utilised. In addition, global studies have recommended the use

of passive investment strategies. For instance, Che and Rui's (2017) evidence from the Chinese market recommends passive funds as a sound choice for investment.

A few of fund managers in Kenya use passive investment strategies. According to scholars (Kirumba, 2011; Iregi and Okeyo, 2017; Osano, 2013), the most commonly used passive investment strategies in Kenya include a few fund managers who prefer conservative investment strategies and risk-averse strategies. It is also pointed out by the studies that these strategies are least utilised.

These passive strategies do not offer diversification as index funds through indexing as in earlier discussions. Gokcen and Yalcin (2015) strongly recommend that low-cost index funds track broad asset indices, therefore, offering diversification be introduced in capital markets. The introduction of index funds in Kenya will thus enable investors to take advantage of the low management fees characterised by index funds. They will also be able to take advantage of the diversified nature of the funds hence lower risk. A number of scholars (Che & Rui, 2017; Crane & Crotty, 2018; Gokcen & Yalcin, 2015) hold that as a result of utilising index funds, better returns can be realised as compared to lower returns of active funds. In summary, index funds are needed in Kenya so that Kenyan investors can take advantage of the opportunities offered by these funds.

1.6 Problem statement

Mutual funds, referred to as collective investment schemes (CIS) in Kenya, are increasing investments and more people becoming are aware of these funds. The CMA (2018) states that mutual funds have grown in popularity in the Kenyan capital markets. It has, however, been found that the funds favour active investment strategies over passive investment strategies (Osano, 2013; Kirumba, 2012; Akama & Jagongo, 2013). Consequently, the general problem with mutual funds in Kenya is the high cost associated with active investment strategies. Akama and Jagongo (2013) point out that actively managed funds in Kenya have shown increased commission costs and transaction costs, and lower returns. Furthermore, Nyamute et al. (2015) note that active investment styles adopted by investors in the NSE attracted hefty fees from managers. Also, trading costs were higher, therefore, lowering the returns made on assets. Furthermore, Akama and Jagongo (2013) found that fund managers' fees could not be compensated by the incremental returns accruing from their management skills and that they cannot consistently beat the market.

To solve the problem of hefty fees characterised by active fund management, passive management strategies have been recommended both in Kenya and globally. Scholars (Iregi & Okeyo, 2017; Kirumba, 2012) emphasise that passive investment strategies have been recommended in managing investment funds in Kenya, to take advantage of the lower costs and higher returns associated with passive strategies. In addition, globally, studies have recommended the use of passive investment strategies, and evidence from the Chinese market recommended passive funds as a better choice in investment (Che & Rui, 2017). The passive investment strategies recommended include the utilisation of index funds that are low-cost and diversified in nature. Index funds utilise indexing, thus offering diversification at lower costs. This attribute differentiates this passive investment strategy from other passive investment strategies. Gokcen and Yalcin (2015) also recommend the use of low-cost index funds that track broad asset indices, therefore, offering diversification in capital markets.

Index funds have not been introduced in Kenya. Scholars (Akama and Jagongo, 2013; CMA, 2016; CMA, 2018) confirm that index funds have not been introduced in the Kenyan capital markets. It is important to have index funds in the Kenyan capital markets, because Kenyan investors will be able to take advantage of low management fees that are characterised by index funds, and the diversified nature of index funds, while realising better returns of index funds as compared to lower returns that characterise active funds. Authors (Che & Rui, 2017; Crane & Crotty, 2018; Gokcen & Yalcin, 2015) note that index funds or passively managed funds are characterised by higher returns in the long term as compared to actively managed funds. Capital markets will benefit in terms of deepening of the market if index funds are introduced. The Oxford Business Group, (2016) also notes that index funds would be an addition to investment products in the Kenyan capital markets. This can create a variety and depth that will attract more domestic retail investors, increasing the number of those currently participating in the capital markets from 4%. Investors' confidence in the market will be increased, and it can spur both structured and economic development (Akama et al., 2013).

Index funds require a number of factors to be in place before it is introduced to a market. It is noted (Nyamute and Jagongo, 2013; Seth & Sharma, 2015; Chitenderu et al., 2014; Dragota & Tilica, 2013) that index funds require the existence of an efficient market where there is a continued inability of active managers to beat the market. The second and third factor that the funds require (Akama & Jagongo, 2013; Brown & Reilly, 2009; Kevin, 2009; Nagarajan & Jayabal, 2011, Saunders & Cornett, 2009) is a

market representative index to track and an adequate regulatory framework for the operation of the fund. From these discussions, it emerges as necessary that the Kenyan capital market is informationally efficient. Secondly, there should be a market representative stock index, and thirdly, an adequate regulatory framework for the introduction of index funds must be in place. Therefore, the specific problem is that, it is not clear whether these factors are in place for the introduction of index funds in Kenya. Hence, the objective of the study is to find out whether the Kenyan capital market is suitable for the introduction of index funds as an investment product within the capital market.

1.7 Research objectives

This section outlines the general objective and the specific research objectives for the present study.

1.7.1 Primary objective

To investigate the suitability of introducing index funds in the Kenyan capital markets and to formulate framework for the introduction of index funds.

1.7.2 Secondary objectives

1. To assess the weak-form Efficient Market Hypothesis (EMH) for the Nairobi Securities Exchange (NSE); and
2. To determine whether the current Nairobi Securities Exchange (NSE) stock indices are representative of the Kenyan capital market

1.8 Research questions

The following are research questions flowing from the research objectives.

1.8.1 Primary research question

Is the Kenyan capital market suitable for the introduction of index funds?

1.8.2 Secondary research question

1. Does the Nairobi Securities Exchange (NSE) follow the weak-form Efficient Market Hypothesis (EMH)?
2. Are the Nairobi Securities Exchange (NSE) stock indices representative of the Kenyan capital market?

1.9 Contribution and benefits of the study

The study contributes to available literature and ongoing debate on passive investment strategies and active investment strategies. Most importantly, it has made a contribution to the scant number of studies conducted to date on African Exchange Markets (AEMs).

Secondly, the study contributes to policy formulation for introducing index fund in the Kenyan capital markets. The study formulates framework for the introduction of index funds. This framework can be utilised in the development of other African Exchange Markets that are found to be inefficient.

Thirdly, the introduction of index funds in the Kenyan capital markets as an investment product will benefit participants of the capital markets. According to scholars (Che and Rui, 2017; Crane and Crotty, 2018; Gokcen and Yalcin, 2015), Kenyan investors will be able to take advantage of the diversified nature of index funds as they track indices that are already diversified. In addition, the investors will take advantage of low management fees characterised by index funds while realising better returns as compared to the lower returns of active funds.

Capital markets will also increase investment vehicles found in the NSE. Akama et al. (2013) point out that index funds as an investment product will increase the choice of investment products, investors' confidence in the market will be increased, as well as spur both structured and economic development. The Oxford Business Group (2016:2) further note out that more investment products in the Kenyan capital markets will attract more domestic retail investors, increasing the number of those currently participating in the capital markets. It is evident as investment products increase within the Kenyan capital markets there is an increased depth within the capital market and more investors will be encouraged to participate due to increased confidence in the capital markets.

1.10 Scope and structure of the study

The scope and structure of this study follows the outline as explained by Jonker and Pennick (2010). This outline was used to draw the boundary of the scope of the study, structure, and methodology of the study. Jonker and Pennick (2010) describe the process of research as one that focuses on the problem description, the research questions, research answers, and solutions. This research has discussed the research problem and research questions in this section. The present study focuses on the investigation

of the suitability of the introduction of index funds in the Kenyan capital markets as its main objective. Two secondary objectives guide the study; they are: assessing the weak-form Efficient Market Hypothesis for the Nairobi Securities Exchange (NSE) and determining whether the current NSE stock indices are representative of the Kenyan capital market. In subsequent sections, data is collected for the research answers and research solutions.

Jonker and Pennick (2010) further add that research comprise the theoretical background of the study and formulation of the conceptual model. The theories that inform this study are the Efficient Market Hypothesis, the Dow theory, Adaptive Market Hypothesis, and modern portfolio theory. Jonker and Pennick (2010:68) add that “the notions used for a particular model need to be made operational and measurable”. The conceptual model was formulated, the model was operationalised and variables measured. As a result of operationalisation and measuring variables, time-series data was collected from the NSE Bourse and the FTSE Bourse and analysed using statistical models. Results of the analysis yielded answers to the objective of the research and conclusions were drawn.

1.11 Assumptions

The study assumes that there is adequate regulatory framework in financial markets. It has been stated (PMC, 2017; Oxford Business Group, 2016) that between 2013 and 2018, Kenya’s financial sector became the third largest in Sub-Saharan Africa with continued regulatory reforms within the sector being done. For example, The Finance Act, Capital Markets Act, and the new companies Act have been passed. In consideration of these continued regulatory reforms and the passing of the Finance Act, the Capital Market Act, and the New Company Act, this study assumes that there is an adequate regulatory framework in place in the Kenyan capital markets.

1.12 Chapter outline

Chapter 1: Introduction to the study

This chapter presented the background of the study as well as a brief discussion of the Kenyan financial system. The definition of index funds is presented in this Section. In addition, the factors required for the introduction of index funds and the need for index funds in Kenya were w discussed. In addition, the problem statement was presented in this chapter, the research objectives outlined, followed by brief discussions of the contributions and benefits of the proposed study. Thereafter, the scope and structure of the study and assumptions were discussed.

Chapter 2 and 3 present the theoretical framework and the conceptual framework.

Chapter 2: Kenyan Financial Sector

The purpose of this chapter is to review the literature for the discussion of the investigation of the suitability of the introduction of index funds in the Kenyan financial capital markets. The chapter starts by giving a background of the study. In the background sub-section financial sector in Kenya is explained and components that make up the sector are discussed. The growth of these sectors are shown and how their growth is a prerequisite for the introduction of investment products in the Kenyan market. The sectors are: the banking sector, the SAACOs, the insurance sector, the pension sector, foreign exchange and capital markets. An in-depth discussion is given on index funds which are core to this study.

Chapter 3: Empirical studies and the principles underlying index funds

This chapter reviews empirical studies and a critical discussion for the purpose of understanding the principle underlying the index funds ensues. Indexing as a passive fund management strategy is discussed and a comparison of the passive and active fund management strategies is given. The study also looks at the performance of active and passive funds in different regions of the World. In this chapter critical discussion of previous similar studies of the EMH is given and research gap explained. In addition, the chapter present factors necessary for the introduction of the funds. These factors are efficient markets hence the underlying theory of the study which is Efficient Market Hypothesis, market representative indices and a regulatory framework is also required.

Chapter 4: Theoretical framework for the investigation of the suitability of introduction of index funds

The chapter discusses the different theories that are related to this study. The theories are discussed together with their assumptions, limitations and criticism. The Efficient Market Hypothesis (EMH) is the main underlying theory of this study. The different levels of informational efficiencies under the EMH are therefore discussed. Market anomalies that arise under this theory are also pointed out. In addition, implications of the EMH are clearly given and how the implications are influencing this study. The Dow theory is also discussed. This is a contrary theory to the EMH. It is, however, discussed because it provides insight to technical analysis, which is an active management strategy that is relied upon in this study. Fundamental analysis is also discussed in the chapter. The adaptive portfolio theory (APT), which is a bridge between proponents of active fund management and passive fund management, is explained.

Lastly, the Modern Portfolio Theory (MPT) that explains diversification is also discussed. This chapter lays the foundation for the conceptual framework discussed in chapter 4.

Chapter 5: A conceptual framework for the investigation of the suitability of the introduction of index funds

This chapter presents the conceptual framework for the investigation of the suitability of the introduction of index funds. The framework explains the independent variables and dependent and their interactions. The conceptual interaction of the EMH with the variables is explained as well. The framework provides conceptual answers to the research questions. According to the framework the study revolves around the NSE. Hence, the history of the NSE is discussed at the beginning of the chapter. Further discussions of the NSE indices are presented, and their interaction with the EMH and market representation. This conceptual understanding guides the choice of methodology and model specification.

Chapter 6: Research Methodology and Methods

The purpose of this chapter is to discuss and present the research methodology and methods that are applied in the investigation of the suitability of introducing index funds in Kenyan capital markets. The research philosophical paradigm, the research approach as well as the broad research approach that is applied in the study are explained. In addition, the issues pertaining to the data which include how the data was collected, sampling of the data as well as data management procedure are discussed. The data analysis procedure followed to determine the suitability of introducing index funds in Kenyan capital markets which is based mainly on time series and econometric methods is presented. Model specification for assessing the weak form Efficient Market Hypothesis (EMH) for the Nairobi Securities Exchange (NSE) are clearly presented. Likewise, model specification for determining whether the current Nairobi Securities Exchange (NSE) are representative for the Kenyan Capital markets are also discussed. Finally, the research ethics followed is outlined.

Chapter 7: Results

Descriptive statistics are clearly illustrated in this section. Results for assessing the weak-form Efficient Market Hypothesis for the Nairobi Securities Exchange (NSE) and determining whether the current NSE stock indices are representative of the Kenyan capital market are presented in this chapter. The next chapter discusses and interprets the results.

Chapter 8: Discussion and interpretation of results

This chapter seeks to fulfil the purpose of the study and address the research problem under investigation. This chapter presents a detailed discussion and interpretation of empirical results of research objectives. A discussion of descriptive statistics of the data is given. Empirical results from the estimated models are explained and the implications of these results are discussed. A framework, that is informed by the results of the study and the imperfections of the NSE, is formulated and presented in this Section. Conclusions and recommendations are presented in the last chapter.

Chapter 9: Conclusions and recommendations

This Chapter draws conclusions and provide recommendations from the discussion of the results to the research problem being studied. The conclusions on the efficiency state of the Nairobi Securities Exchange (NSE) for the introduction of index funds and the state of market representativeness of the NSE stock indices are discussed. Policy implications as implied by the results are discussed and the contributions of the study. Recommendations are given with regard to the research problem and future research.

CHAPTER 2

The Kenyan Financial Sector

2.1 Introduction

The purpose of this chapter is to discuss the Kenyan financial sector. It aims at discussing the financial sector with a view to understand the background of the Kenyan capital market. In addition, an in-depth discussion of index funds is given.

The question is whether the Kenyan capital market is ready for the funds. The Kenyan financial sector has shown growth and developed over the past few years, and has proved that there is market for investment products within the sector. In addition, Collective Investment Schemes (CIS) are in place. These schemes house the unit trust schemes under which index funds can be legally registered and introduced to Kenyan capital markets.

The chapter unfolds as follows: Section 2.2 discusses the background of the study, under this Section the banking sector is discussed in sub-section 2.2.1, sub-section 2.2.2 discusses the savings and the credit cooperative societies (Saccos), 2.2.3 explains the Insurance sector, under 2.2.4 the pension sector is explained, 2.2.5 discuss the foreign exchange, while the capital markets are discussed in 2.2.6, sub-section 2.2.7 explains the Collective Investment Schemes (CIS), 2.2.8 discusses investment companies, 2.2.9 gives a comparison of the closed-ended funds and open ended funds, 2.2.10 discusses the closed-ended funds, 2.2.11 explains open ended funds, 2.2.12 gives an in-depth discussion of mutual funds and finally Section 2.3 defines and explains index funds.

2.2 Background of the Kenyan financial sector

The financial sector in Kenya is one of the most dynamic sectors and is one that has experienced tremendous growth and changes in the past few years. This is attributed to the technological innovations like money transfer platforms. Mpesa, for example, is a unique Kenyan innovation that has transformed the sector. The Financial Sector (2019) points out that the sector is adopting new business models including financial technologies and innovations to drive growth and manage risks. These demonstrate the flexibility of the sector in adopting new technology. Kenya's financial sector also remains stable despite risks within the market. For instance, according to the Financial Sector (2019), the banking sector has sufficient capital reserves to withstand shocks.

Growth and changes within the sector that have been initialised by both the private sector and the Government. The Financial Sector Regulators Stability Report (2019) recognises the following developments that have been initiated by either parties: reforms that the sector has undergone between 2000 and 2018, the banking sector has experienced an increase in the number of banks and an increase in deposits as well as innovation, and capital markets have developed and more investment products have been introduced. These contribute towards the deepening of the capital markets. The regulators also point out the financial innovations that have been realised in the financial markets with the most commendable innovations being the infrastructure bond offered to the general market at very affordable rates through the M-Akiba platform. The mobile money transfer platform M-Pesa has also revolutionised the financial sector in Kenya, and many countries have adopted this form of money transfer that originated in this country. Also, a number of micro- finance institutions have grown, and some have transformed into banks like the Kenya Women Microfinance Bank PLC (KWFT). There has been a surge in the insurance sector SACCOs as well.

The financial sector has aimed to improve financial deepening. This means the financial inclusion of Kenyans and increasing financial products. There has, thus, been a deepening in financial inclusion, and many Kenyans have access to financial services. Heyer and King (2015) point out that Kenya's transformation of financial services has been very impressive, and 75% of adults have a formal account that enables savings and receipt of money. Furthermore, over 89% of Kenyans could access financial services as at the end of 2018 (financial sector regulators, 2019). These figures demonstrate the economic potential that is within Kenya. If this potential is exploited, more Kenyans can participate in the capital markets. Heyer and King (2015) note that these percentage figures are above the global average, and Kenya is performing better than many middle-income countries like Chile, Brazil and India. Financial deepening includes having a wide range of financial products in the market. Heyer and King (2015) recognise that Kenya is a regional leader in financial innovations with innovations like M-Pesa, M-Shwari, M-Akiba, and agency banking. The authors also point out, however, that there is room for more innovations and more products. Thus, depending on the informational efficiency of the market and the representativeness of the market, index funds can be introduced in this context.

The financial sector, according to Sasra (2020), comprises deposit-taking institutions which include commercial banks, mortgage refinance companies, and microfinance banks which are all regulated by the CBK. Other deposit-taking institutions include the deposit-taking SACCOs (DT-SACCOs) and the regulated non-withdrawable deposit-taking SACCOs which are regulated by the Sasra. Non -deposit taking institutions include the insurance; pensions; and the capital markets sectors. Regulatory bodies in the financial sector include the Central Bank of Kenya (CBK); the Sacco Societies' Regulatory Authority (SASRA); the Retirement Benefits Authority (RBA); the Insurance Regulatory Authority (IRA); the Capital Market Authority (CMA) & other Government ministries. Financial market infrastructure is also part of the financial sector the infrastructure is an interconnected system that includes Fin-Tech. This enables payments, settlement and custodial services and international operations. Informal finance providers are also part of the financial sector. Informal sector is a well-structured subsector that serves a community of people it includes rotational savings groups popularly known as Chamas, amongst others.

The following sections provide further context to this study. Under the financial sector, a brief discussion is given on the banking sector, the SACCOs sector, the insurance sector, the pensions sector, the foreign exchange sector, and finally capital markets are discussed and products offered explained. An in-depth discussion of Collective Investment Schemes (CIS) in Kenya follows.

2.2.1 Banking Sector

The banking sector in Kenya consists of many institutions that have grown and undergone transformation since independence. According to the CBK bank supervision report (2020) and the financial sector regulators (2019), the components of the banking sector include public banking institutions and private banking institutions. These comprise local commercial banks and foreign commercial banks. Others include non-operating bank holding companies, forex bureaus, micro finance banks (MFBs), credit reference bureaus (CRBs), money remittance providers (MRPs), foreign bank representative offices, mortgage refinance company, and foreign banks representative offices. These institutions have generally increased over the years and by end of 2019 according to the CBK bank report there were a total of 175 banking institutions in Kenya.

These banking sector institutions are key in the economic development, and thus require adequate supervision and adequate regulatory framework. The Central Bank of Kenya (CBK) plays the role of banking sector's regulator and supervisor under the Central Bank Act (Cap 491). According to the CBK

(2019), the “Bank Supervision Department (BSD)’s purpose as outlined under Section 4(2) of the Central Bank of Kenya Act is to enhance solvency, liquidity, and ensure proper functioning of the financial system. This infers that the CBK plays the role of ensuring a conducive environment for banking operations. Therefore, one of CBK’s key functions according to CBK (2019) include the development of the legal and regulatory framework that govern the banking sector together with the review of the different Acts of parliament that regulate the institutions that are under it.

Generally, banks in Kenya have made tremendous improvements over the years in terms of total assets, capital reserves, and deposits. Between 2019 and 2020, there were improvements and CBK (2020) noted the growth and said that the total banks’ assets have increased to Kes. 5.4 trillion as on December 31, 2020. This can be compared to Kes.4.8 trillion as at December 2019, marking a growth of 12.4%. This is applicable to all bank categories within the sector. The CBK (2019) indicates that banks are divided into small, medium and large. This categorisation is achieved by using a weighted composite index that comprises of the net assets, customer deposits, capital and reserves, number of deposit accounts and number of loan accounts. Banks with a composite index of above 1% and below are rated as small banks, while banks of between 1 to 5% are medium banks and banks with a composite index of above 5% are regarded as large banks.

Microfinance banks have made significant increases and improvements over the past ten years. These banks have assisted in the financial inclusion of the majority of Kenyans who found formal banking to be inaccessible. CBK (2010) notes that MFBs have moved from social financial empowerment programmes to financial institutions that are legally operated and bridge the gap of financial inclusion. This proves that MFBs have played a key role in the development of the banking sector. This is another indication of potential in this sphere that can be exploited by capital markets.

Foreign exchange bureaus have, perhaps surprisingly, decreased in number since 2010. The bank supervision report of 2010 reported 126 forex bureaus in Kenya. On the other hand, the bank supervision report of 2019 reported a total of 69 forex bureaus in Kenya, indicating a sharp decline. The forex bureaus, however, operated a total of 107 outlets countrywide as at December 31, 2019 as compared to 126 outlets operated country wide in 2010. It is, however, interesting to note that 101 of the outlets were located in Nairobi in 2010, and 82 of the outlets were located in Nairobi as at December 31, 2019. It is

can therefore be presumed that as much as the number of forex bureaus in Kenya has decreased in number, the concentration of these bureaus is no longer in Nairobi. Instead, the bureaus are spread across the country, an indication of new markets, and thus more people are aware and are utilising forex bureau services.

Growth in the banking sector and foreign exchange bureaus is a clear indication of a sector that can be developed and harnessed further to encourage greater economic growth. This shows that there is a ready market for capital markets investment vehicles.

2.2.2 Savings and the credit cooperative societies (Saccos) sector

Saccos are associations of individuals with a common goal whose main purpose is to pool funds enabling them save and borrow. The Financial Sector Regulators (2010) in the Kenya Financial Sector Stability report 2010 define Sacco as a special type of co-operative offering financial services, where individuals come together through membership with the aim of pooling funds through savings and advancing affordable credit to its members who are both the owners and users of the co-operatives. In addition, Sasra (2010) explains that Saccos ownership is based on a common bond. For instance, there are Saccos that have a membership base of Government employees, teachers, farmers, and private sector employees. As a result, the Saccos have enabled economic growth through the development of its members by financial empowerment through a guarantee system. Due to this system, Saccos have become very popular among the low- and middle-income individuals.

Saccos have grown over the years and from 2010 to date. The Sasra (2020) report on Sacco Supervision for the year 2020 showed an increase during the years 2018, 2019, and 2020 in total assets of Kes. in billions of 495.25, 556.71, 627.68, while total deposits were Kes. in billions 341.91, 380.44, 431.46 respectively. The net loans and advances in 2018 were Kes. billions 359.02, an increase of 11.46% from the previous year, in the year 2019 and 2020 Kes. billions 400.16 and 450.58 were reported as net loan and advancement respectively the increase was 12.60%. These figures show that deposits sufficiently covered loan advancement. Capital reserves increased for the years 2018, 2019, and 2020 in the same period from Kes. in billions 83.76, 97.55, to 115.28. This is an increase in percentage of 16.47%, 18.18% respectively.

Saccos as part of the financial sector and markets have played a salient role amongst the low- and middle-income persons in Kenya. The amount of deposits has increased over the years, showing that Kenyans have the propensity towards savings and investment. The financial markets can take advantage of this fact and introduce more products that will encourage long-term savings and investments.

2.2.3 Insurance sector

The insurance sector in Kenya has equally been active had an impact in Kenya. The financial regulators (2011) communicated in its annual report that by 31st December, 2010, the insurance sector comprised of re-insurance companies (which were 2 in number). It boasted 47 insurance companies, 158 insurance brokers, 23 medical insurance providers, and 3,788 insurance agents. Other insurance participants in Kenya are loss assessors, insurance investigators, loss adjusters, surveyors and claims settlement agents.

Growth has been experienced in the recent past, notably between 2015 and 2018. However, Financial regulators (2019) indicates that the gross direct premiums have grown at a decreasing rate and the uptake of insurance products as measured by the ratio of insurance premium to GDP reduced in 2018 to 2.68% as compared to 2017. Thus, rigorous education of the public on insurance products and benefits of insurance is necessary. The regulators pointed out that there has been increase in insurance coverage from 6.7 percent in 2017 to 8.99 percent in 2018; a number of policies were increasing by 9.2 percent, from 3,139,984 policies in 2017 to 3,429,307 policies in 2018. This increase is ascribed to the uptake of insurance products by county governments and corporate organisations. As such, it further justifies the need for educating the general public on the benefits of insurance products uptake. Assets held by the insurance sector has increased in the periods 2015, 2016, 2017, and 2018 from Kes. Millions 426.31, Kes. millions 478.75, Kes. millions 528.75, Kes. millions 590.95, and Kes. millions 637.41, respectively. Again justifying the readiness of the market for index funds.

2.2.4 The pension sector

The pension sector is comprised of various components and is regulated by the Retirement Benefits Authority (RBA). As on 31st December, 2010, the sector comprised seventeen fund managers, 1, 288 registered retirement benefits schemes, ten custodians and 25 registered administrators.

Apart from the growth in the number of participants in the sector, growth has also been experienced in terms of assets. Between the years 2005 to 2010, the sector assets increased and were Kes. Billions 293.7,

321.2, 302.8, 317.7, 343.8, and 450.69 respectively, and in the same period, the sector held 31.9% of government securities while 28.9% of the investments were held in quoted securities (Financial regulators 2011). This situation implies low-risk investment choices, and thus capital preservation for pensioners. Despite low coverage of pension schemes in Kenya, Financial regulators (2019) notes that the sector has registered further growth in assets from 696 billion in 2013 to KSh 1,166.34 billion in December 2018. Pension coverage has remained at 20.01 percent in 2018. Similarly, up until 2010, the sector invested heavily in government securities.

2.2.5 Foreign exchange

The foreign exchange sector has been volatile due to the overall weakening of the Kenya shilling over the years. In 2010, the exchange rate weakened due to the strengthening of the US\$ in the international markets. The Financial regulators (2011) reports that the weakening Kenya shilling experienced in 2010 could lead to instability in financial sector, because of its negative impact on the trade balance, as well as on higher external debt service and foreign reserves. Another consequence is the withdrawal of foreign investors from the financial markets and a high rate of inflation.

Despite these realities, it is necessary to point out that the shilling appreciated against other currencies between the periods between 2010 and 2018. Financial regulators (2019) established that although the appreciation was slight against other currencies, the Kenyan shilling experienced a measure of stability. This is because of increased diaspora remittances, reduced imports bill and a narrow Current Account Balance (CAB). The report projected stability for the local currency in 2019 due to the factors noted above; however, increases in global oil prices, geopolitical tensions and global trade wars could create risks in the foreign exchange market.

2.2.6 Capital markets

Capital markets in Kenya have developed and transformed to become one of the leading markets in the East African region. The capital markets industry in Kenya comprises institutions and agencies that are regulated by the Capital Markets Authority (CMA) (CMA website, 2019). The CMA is responsible for orderliness in the industry and adherence to the regulatory framework by industry participants. This authority was formed by an ACT of parliament, Cap 485 A under the National Treasury and Planning. The major Acts that the Authority operates under are the Capital Markets Act and the Central Depositories Act 2000. The overview of regulatory framework's 2019 report published by the CMA

demonstrates that the CMA enforces the above-mentioned Acts in its supervision of the industry and has several regulations that it implements. The regulations include the Capital Markets (Collective Investment Schemes) Regulations, 2001 and the Capital Markets (Securities) (Public Offers, Listing and Disclosures) Regulations, 2002. The Capital Markets (Licensing Requirements) (General) Regulations, 2002, the Capital Markets (Takeovers and Mergers) Regulations, 2002, and the Capital Markets (Foreign Investors) Regulations, 2002. The Capital Markets Tribunal Rules, 2002, the Capital Markets Asset Backed Securities Regulations 2007, the Capital Markets (Registered Venture Capital Companies) Regulations 2007, the Capital Markets (Conduct of Business) (Market Intermediaries) Regulations 2011 are also included. Furthermore, there are the Capital Markets (Corporate Governance) (Market Intermediaries) Regulations, 2011, the Capital Markets (Demutualisation of the Nairobi Securities Exchange Limited) Regulations 2012, the Capital Markets Real Estate Investment Trusts Collective Investment Schemes Regulations 2013 and the Capital Markets (Derivatives Markets) Regulations, 2015.

It may be deduced that there is adequate regulation to govern the capital markets since it seems that majority of components of the capital markets have regulations that govern it. The guidelines enforced by the Authority also include a Code of Corporate Governance Requirements for Issuers of Securities to the public, 2015, and Guidelines on the Approval and Registration of Credit Rating Agencies and Guidelines on Financial Resource Requirements for Market Intermediaries. One of the assumptions of this study is that there are adequate laws and regulations in place for the introduction of index funds in Kenya. The above-mentioned regulations, code and guidelines that are implemented by the CMA to regulate capital markets is an indication of the adequacy of the laws and regulation.

The existing primary capital markets also offer a range of products approved by the CMA. These products range from equity issues, rights issues, stock splits, bonus issues, corporate bonds, and treasury bonds. The published annual report and financial statements for the year ending 30th June 2021 prepared by the CMA indicates that the total volume of shares listed and issued for the first time at the primary equity markets from 2006 to 2021 amounted to 6, 148, 450, 893. Based on the equity issues, one can presume that the primary market has been very active and vibrant market. These equity issues, rights issues, bonus issues, and stock splits issues are a sign of progress, as well as a deepening and growth of the primary capital markets. They are also a sign that there are many investors and potential investors interested in investing in the capital markets.

Bonds have been offered in the Kenyan primary capital markets, and there has been an increase in both treasury bond issues and corporate bond issues. The tax-free Government infrastructure bond is the most popular. The published annual report and financial statements for the year ending 30th June 2021 prepared by the CMA states that during the 2020/21 financial year, twenty-nine treasury bonds (that is 19 reopenings, five new issues, five tap sales, and four and three infrastructure development bond issuances) were issued. The Authority states that the Government intent was to raise Kes.725 billion, but Kes. 785.35 billion was raised from the issue. Oversubscription of Government bonds justifies the demand for the bonds that is within the market. This is done bearing in mind that Government bonds are low-risk securities. This implies that there is a market for such kind of investment opportunities. Index funds are well diversified financial instruments and therefore the risk they present is lower, similar to Government bonds. One could thus make the assumption that there is a ready market for these types of funds.

Similar to the primary capital markets, the secondary capital markets have grown steadily over the years. The CMA (2021) has noted this fact in the Kenya financial sector's stability report published by the authority. The share volume traded in millions was 1,455, 1,938, 5,857, 3,169, 7,181 for the years 2006, 2007, 2008, 2009, and 2010 respectively, while movements of the NSE index values for the same years were at 5,646, 5,445, 3,521, 3,247, and 4,432 respectively. The market capitalisation for the years 2006, 2007, 2008, 2009, and 2010 were (Kes. Bn) 792, 851, 854, 834, 1,167 respectively.

The CMA is also responsible for the deepening of the capital markets, market research, product development and for creating awareness of capital markets. The CMA annual report of the year (2021:111) indicates that the strategy for market deepening and product uptake initiatives included, "seeking strategic partnerships, undertaking targeted stakeholder engagements and pursuing innovation to promote increased uptake of existing capital market products and services". This demonstrates a concerted effort by the Authority and stakeholders. Further suggesting that more Kenyans are becoming aware of the investment opportunities offered by the capital markets. Therefore, if these efforts are consistently applied, an increase in product uptake and subsequently increased investments is likely.

The CMA has been a salient player in leveraging technology to boost its activities. Apart from being in the process of developing its own app and other innovative products, "the CMA joined 23 regulators

across five continents to test innovative financial products, services, business models and regulatory technology in November 2021” (CMA, 2021:114). This is an indication that innovation and product development are at the heart of capital markets development. Indeed, the Authority has been commended for its innovative products in the past as in prior discussions.

In this regard, it is important for the CMA to consider introducing index funds in the Kenyan capital markets. This fund will enable investors to create wealth and, in the long run, to build the economy. If introduced into the market, the funds would be registered under the Collective Investment Schemes (CIS) as a unit trust. The following section presents a discussion of Collective Investment Schemes in Kenya and how they relate to this study.

2.2.7 Collective Investment Schemes (CIS)

The financial markets in Kenya have grown over time, as noted above, and one of the sectors that has grown is the investment sector. Collective investment schemes (CIS) enable many Kenyans to invest in local investment vehicles that are offered in financial markets. These schemes are organised by fund managers. The schemes are registered either as investment companies, unit trusts, or partnerships. The Capital Markets Acts Cap 488 A defines a collective investment scheme as including,

“an investment company, a unit trust, a mutual fund or other scheme whether or not established or organized in Kenya which collects and pools funds from the public or a Section of the public for the purpose of investment; is managed by or on behalf of the scheme by the promoter of the scheme; and includes an umbrella scheme whose shares as herein defined are split into a number of different class schemes or sub schemes, each of which is managed by or on behalf of a common promoter”.

This proves that a collective investment scheme (CIS) encompasses mutual funds of which an index fund is one. Under the Capital Markets Authority (Collective Investment Schemes) regulations (2022), a CIS that is an investment company is established by Articles of Association registered under Companies Act by the Company’s registry; a CIS that is a unit trust is established by a Trust Deed Under Unit Trust Act, and a CIS that is a partnership shall be established by a partnership agreement and as a limited liability partnership under the Partnership Act. The CMA (2022) also requires that fund managers should ensure that the established or an operating CIS is approved and licensed by CMA. As much as the CIS are legally established under the respective Acts of law, they must be approved by the CMA to legitimise their operations. This suggests that there is investor protection due to the stringent laws that are in place.

The majority of the CIS are registered as unit trusts. They are the most common investment vehicles in Kenya. The present study's focus is on unit trusts. The Capital Markets Acts Cap 488 A defines a unit trust as,

“any scheme or arrangement in the nature of a trust in pursuance whereof members of the public are invited or permitted, as beneficiaries under the trust, to acquire an interest or undivided share (unit of investment) in one or more groups or blocks of specified securities and to participate proportionately in the income or profits derived therefrom”.

A unit in this case means a participatory investment (CMA, 2022). This infers that in Kenya, a CIS is a mutual fund, and these funds are offered to investors through unit trusts where a fund manager brings investors together through the pooling of funds for the sake of taking advantage of economies of scale. This also enables individual investors to invest in larger investment projects than they could have done as individuals.

There are many types of unit trusts funds in Kenya. These are categorised into capital preservation funds (which are the money markets funds), growth funds (which are equity funds), income funds (which are fixed income funds) and blended objectives funds, which are balanced funds (Kihara & Owino 2022). These funds are operated and offered by various unit trust schemes in Kenya that are registered under the CMA.

Unit Trust funds may be legally registered under the Acts as mentioned, but they must also be licensed and authorised by the CMA. Investors are advised to only invest in funds that are licensed by the CMA. The CMA website list of licensees as on May 2022 shows the unit trust schemes licensed by the CMA as Alliance Kenya Unit Trust Scheme, British-American Unit Trust Scheme, NCBA Unit Trust Funds, Zimele Unit Trust Scheme, ICEA Unit Trust Scheme, and Standard Investment Trust Funds amongst others.

The collective investment schemes are managed by fund managers who are licensed by the CMA and who employ active fund management strategies (CMA, 2022). This situation suggests that these schemes attract management fees and other fees which might have a negative impact on returns.

The assets under management by the CIS have increased over the years, confirming the notion that Kenya has potential in terms of capital markets. According to the CMA Quarterly Statistics Bulletin (2022), as on December 31, 2021, the total assets under management (AUM) by the CIS were KShs. 134,668,490,784.73 billion. There was an increase of 6.84% from KShs. 126,047,735,882.16 billion managed in the quarter ended September 30, 2021.

The statistics on AUM demonstrates an increasing interest in investment opportunities by the public. Thus, an increase of investment products in the financial markets means offering diversity and meeting the need of the market. An introduction of index funds will provide investors the option of investing in passive funds. The market at large will have the benefit of diversification at a low cost with possibility of higher returns. Index funds will be registered and operated as a CIS under Unit Trusts Act and licensed by the CMA.

Funds operated by the Unit Trusts Schemes in Kenya can either be open or closed-ended. In other parts of the world, open-ended and closed-ended funds are operated as investment companies. In the subsequent section, a discussion on investment companies and examples of closed and open-ended funds operated under investment companies is presented. The equivalent open-ended and closed-ended funds operated under Unit Trust Schemes in Kenya are also perused in the section that follows.

2.2.8 Investment companies

Generally speaking, investment companies fall in to two categories: open-ended and closed -ended companies. Bodie et al. (2011) explain that closed-ended companies include, of among others, exchange traded funds (ETFs) and real estate investment trusts (REITs). On the other hand, open-ended funds include mutual funds, hedge funds, unit investment trusts (UITs), and commingled funds.

Investment companies pool funds for the sake of investing. Various scholars (Bodie et al., 2011; Jones 2010) define an investment company as a financial intermediary that is involved in bringing together funds from different investors and investing the pooled funds in a portfolio of assets and offering managing the portfolio on behalf of the investors. In addition, each investor owns a portion of the portfolio according to amount invested in the portfolio and investor enjoys diversification of investment offered by the investment company. This shows that individuals who might not have large amounts of

funds can make investments with their limited funds through investment companies, in a similar manner to mutual funds. According to Bodie et al. (2011), investment companies offer important functions which include the diversification and divisibility of funds, professional management of the invested funds, lower transactional costs in terms of brokerage fees and commissions, and record-keeping and administration. Similarly, CIS in Kenya offer diversification, divisibility of funds and professional management through unit trusts that pool funds for investment purposes.

2.2.9 Closed-ended funds vs open-ended funds

Closed funds which comprise of exchange traded funds (ETFs) and real estate investments trust (REITs), as noted, are funds that are traded in an organised exchange. Bodie et al. (2011) state that investors wishing to invest in a closed-ended fund must do so through brokers and treat shares in this fund as would a stock that is traded in a stock exchange. This infers exposure to the exchange and existing conditions of the exchange. Investors wishing redeem shares of a REIT or an ETF must sell to other investors through the exchange. This means that the outstanding shares remain the same daily and the price can fall below the NAV (Bodie et al., 2011). In the Kenyan context, the CMA (2022) describes a closed-ended fund as, “a scheme approved by the CMA which is constituted in a legal form, with a fixed capital, which pools funds from subscribers by private placement and invest them in a portfolio as approved by the CMA”. On the other hand, scholars (Bodie et al., 2011; Jones, 2010) describe open-ended funds as funds that are not traded in any exchange fund. For an investor to buy shares or redeem shares, they must transact directly with the fund. In addition, according to these authors, shares are purchased at Net Asset Value (NAV). If the share carries a load (sales charge), the share will be above the NAV. For the redemption of shares by investors, shares must be sold back to the fund at NAV. The NAV is basically the share price of an open-ended fund. As a result, while both types of funds offer investment opportunities, their operations differ and an investor needs to understand the differences between these funds with a view to ascertain whether his or her investment needs will be met by a particular type of fund. The CMA (2020) states that in Kenya, unit trusts that operate closed-ended funds have the underlying investment vehicle listed at the NSE, and it is traded on the exchange like any other form of stock. Open-ended funds in Kenya are similar to what is discussed above, and at the end of the day, the NAV value is calculated.

2.2.10 Closed-ended funds

REITs, as the name suggests, are funds that are involved with the real estate and as noted earlier, they are closed-ended funds. There are different types of REITs. Bodie et al. (2011) explain that investors can invest in real estate or loans secured by the real estate. Equity trusts invest in real estate directly, and mortgage trusts invest primarily in mortgage and construction loans. Kenyan REITs are divided into two categories: the developmental REITs and the income REITs. The developmental right enables investors to be part of real estate development projects and earn a return, while the income REITs enable investors to invest in real estate for the purpose of earning an income.

The CMA has authorised the following REITs in Kenya: The Acorn Development Real Estate Investment Trust (Acorn D-REIT), the Acorn Income Real Estate Investment Trust (Acorn I-REIT) and ILAM Fahari I-REIT. The rights trustees in Kenya include the Housing Finance Company (K) Limited, the Co-operative Bank of Kenya Limited, and Kenya Commercial Bank Limited. Licensed REITS managers include Nabo Capital Limited, Asset Management Limited, Fusion Investment Management Limited, Stanlib Kenya Limited, ICEA Lion Asset Management, Sterling REIT Asset Management, Britam Asset Managers Limited, Cytonn Asset Managers Limited, and Acorn Investment Management Limited.

Exchange traded funds (ETFs) are closed-ended funds. These funds were first introduced into financial markets in 1993, and are traded in an exchange situation like any other stock is traded in a stock exchange. Jones (2011) indicates that when ETFs were first introduced into the market, they were passively managed and tracked a given index hence diversification. However, this has changed over time, and since 2008 some ETFs have been actively managed. The majority of the ETFs are, however, passively managed.

ETFs are diversified and now track commodities, industry indexes, international indexes among others but index-based ETFs are in the majority (Bodie et al., 2011). Jones (2010) adds that because ETFs are passively managed, their annual expense ratio is lower. This suggests that ETF and index funds returns are similar. However, the daily transactions in an exchange might suggest slight differences between index funds and ETFs in terms of returns. Jones (2010) further notes that ETFs are tax efficient because they do not report capital gains over the year, even if capital gains distribution occurs and dividends are distributed to shareholders in the case where ETFs hold shares of companies that pay dividends. It has

also been noted that ETFs are tax efficient compared to mutual funds. Despite, this tax advantage ETFs can be costlier than index funds. Bodie et al. (2011) indicate that because of trading, in an exchange, the NAV value of an ETF can easily increase, and this increase can nullify the cost effectiveness of ETFs. Indeed, a slight increase can affect the cost advantage negatively. Brokerage fees also impacts on the cost advantage. This is an implication of lower returns than those of index returns. Jones (2010) gives examples of ETFs as; “Spider” (Standard and Poors Depository Receipt), “Cubes” (Nasdaq 100 Index Tracking Stock) and the “Diamond” (the DJIA) . An example of an ETF in Kenya is the New Gold ETF that is a commodity-based ETF and is listed in the NSE. The Kenyan ETF has, however, been described as costly (NSE, 2020).

2.2.11 Open-ended funds

Open-ended funds, as mentioned earlier, include unit invested trusts (UITs), commingled funds, hedge funds, and mutual funds. Unit invested trusts (UITs) are passively managed funds that have lost popularity over the years. Bodie et al. (2011) explain that UITs have dwindle in popularity in terms of mutual funds and assets in UITs that have declined from \$105 billion in 1990 to \$29 billion in 2009. These authors define UITs as pools of money that invest in uniform types of assets and investors can purchase shares or units of the trust that are known as redeemable trust certificates at NAV. It is necessary to mention that the uniformity of assets might have contributed to the loss of popularity of the fund in favour of mutual funds. Bodie et al. (2011) note that passive funds are invested in fixed portfolios for the life of the fund, and income and payments are paid out by the trustees of the fund who are usually banks or trust companies.

Commingled funds and hedge funds further examples of open-ended funds. Commingled funds, similarly to UITs, are sold to investors as units at NAV and a bank or insurance may offer an array of commingled funds (Bodie et al., 2011). Hedge funds, on the other hand, are private partnerships that are illiquid in nature because partners enter into lockup agreements that can last for several years. These funds are opened to institutional investors and wealthy individuals. Due to the private partnerships associated with hedge funds, regulation is minimal and therefore these funds can pursue a variety of investment strategies (Bodie et al., 2011).

2.2.12 Mutual funds

Collective investment schemes (CIS) in Kenya are legal entities under which mutual funds are managed. The CIS in Kenya, as discussed earlier, are registered as either investment companies, a unit trust or a partnership. CIS that are registered as unit trusts are more common in Kenya than any other form of CIS. In the Kenyan context, unit trusts offer mutual funds. A mutual fund pools funds together for investment purposes. Scholars (Bodie et al., 2011; Jones, 2010) describe mutual funds as investment companies that are open-ended and which are managed by fund managers who may also be the fund sponsors. This implies that these are pooled funds that are not traded at any exchange, and thus shares must be bought at the fund. Typically, the fund managers charge a fee of between 2 - 1.5%. It is necessary to mention that these fund management fees together with other costs such as tax and administrative costs lower investors' returns. Also, these funds operate under a fund policy that guides the fund in terms of what kind of investments to invest in (Bodie et. al., 2011; Jones, 2010). Different types of mutual funds are further discussed in the subsequent sections.

One of the major types of mutual funds are sector funds. These may include the agricultural sector, manufacturing sector, aviation industry, and the hotel industry. Bodie et al. (2011) define sector funds as an equity fund that focusses on a particular sector, as the name implies.

Money market funds constitute a further type of a fund. A money market fund is a capital preserving mutual fund that has proved to be popular, especially in Kenya. This is a fund that invests in low-risk short-term securities with flexible withdrawals. The short-term securities allow investors to invest small amounts of money. Bodie et al. (2011) mention that short-term securities have an average maturity of a little longer than a month. These short-term securities can assume the form of commercial papers, treasury bills, federal funds, bills of exchange, certificate deposits, or repurchase agreements. Ninety per cent of unit trusts registered under the CMA operate money market funds and they invest typically in fixed deposits, call deposits, treasury bills, commercial papers and short-term bonds. The fact that 90% of unit trusts operate money markets funds demonstrates the popularity of this funds in the Kenyan financial market. Examples of the money market funds in the Kenyan financial markets are the British-American Money Market Fund by the British-American Unit Trust Scheme, the Co-op Money Market funds by Co-op Trust Fund, the CIC Money market fund by CIC Unit Trust Scheme, and the Old Mutual Money Market Fund by Old Mutual Unit Trust Scheme, among others (CMA, 2022).

Bond funds are mutual funds that focus on investing in bonds. Scholars (Jones, 2010; Bodie et al., 2011) explain that these funds focus on fixed income securities and specialise in, and focus on mortgage-backed bonds, treasury-backed bonds or corporate backed bonds, amongst others. Bond funds are offered in the Kenyan market. These funds are offered under Unit Trust Schemes; examples are the Old Mutual Bond Fund by the Old Mutual Unit Trust Scheme, Nabo Africa Fixed Income Fund by Nabo Africa Funds, Diaspora Bond Fund by Diaspora Unit Trust Scheme and ICEA Bond Fund by ICEA Unit Trust Scheme (CMA, 2022).

Another type of mutual fund is the equity fund. This fund invests in equities. A certain small percentage of their income may be in other securities such as the money market, which enables liquidity of the funds for purposes of redemption of shares by investors. However, their main focus is investment in equities. Bodie et al. (2011) reinforce this notion, adding that the funds' main investments is in equity funds, but management may decide to hold 4-5% of its investment in other securities for liquidity purposes. Moreover, these authors purport that equity funds can either be growth funds or income funds. While the growth funds are riskier and focus on capital gains, income funds focus on investing in shares with consistent high dividend yields. It follows from the fact that this funds target investors with are inclined to high-risk investments. In Kenya, equity funds are categorised under growth funds. Examples of equity funds offered in Kenya are the ICEA Equity Fund by ICEA Unit Trust Scheme, African Alliance Kenya Equity Fund by African Alliance Kenya Unit Trust Scheme, Dyer and Blair Equity Fund by Dyer and Blair Unit Trust Scheme and GenCap Hisa Fund (Equity Fund) by Genghis Unit Trust Funds.

Balanced funds are part of mutual funds and, as the name suggests, these are flexible to the needs of the investor. Bodie et al. (2011) define balanced funds as mutual funds that offer investors the opportunity to invest in funds that suit the individual investor – for instance, lifecycle funds that can be suitable for either young or older investors. These funds invest in both bonds and equity.

A similar fund to the balanced funds are the asset allocation and flexible funds. Bodie et al. (2011) explain that this kind of mutual fund holds both the equity and bond securities in proportions that are at the discretion of the fund manager forecasting skills. As a result, they tend to be riskier than balanced funds. Therefore, the fund managers' ability to forecast determines the performance of the funds is salient. In

the sections that follow, it is shown that unless a fund manager exhibits superior skills in this regard, it is difficult to beat a risk-adjusted passive benchmark. Balanced funds are offered in Kenya through unit trust schemes, such as Sanlam Balanced Fund (Sanlam Chama Plus Fund), Nabo Africa Balanced Fund, Amana Balanced Fund, Standard Investment Balanced Fund and Nabo Africa Balanced Fund.

International funds are also mutual funds. According to Bodie et al. (2011), international funds are funds that focus on stocks of firms that are located outside the mutual fund's domiciled country.

Finally, index funds, which are the centre of this study, are a form of mutual fund that is low-cost, diversified and tend to outperform a benchmark index. Kenya does not have a CIS or investment company that offers this index funds (Akama & Jagongo, 2013; CMA, 2016; CMA, 2018). This study explores the suitability of introducing index funds in Kenya. Mutual funds were discussed in this section where it was demonstrated that Kenya has most of the types of mutual funds offered found in other parts of the world. Mutual funds in Kenya are operated under unit trusts schemes, and the majority of these funds are actively managed (as stated in Chapter One). Passively managed funds are rare in Kenya, and thus it makes sense to consider introducing index funds. Index funds are the focus of this study, and the next section discusses index funds and indexing.

2.3 Index Funds

As mentioned in Chapter One, this study adapts a definition of index funds proposed by a number of scholars (Brown and Reilly, 2009:545; Saunders and Cornett, 2009:495; Bodie *et al.*, 2010:235). These authors define index funds as passive funds that are a capital market's financial instrument that match or replicate performance of a stock index. In this context, fund managers buy securities that are the exact composition of a stock index or invest in a sample of stock that mimic the stock index. This definition leads one to believe that there are three strong implications concerning index funds. Firstly, index funds require a representative index to be available. Secondly, the funds are capital markets instruments that are passive. Thirdly, the funds mimic a given index. Examples of already existing index funds are the Vanguard's 500 index fund, which is the oldest, and the Standard and Poor's Composite index funds (Jones, 2010).

Also, index funds have been heralded for their ability to earn higher returns in the long run compared to other forms of investment funds, their diversified nature, and the fact that they are low-cost. The reason

behind their higher returns is the passive management technique that are applied in the management of these funds. Jones (2010) indicates that index funds are passively managed, and they duplicate a chosen index, thus the lower expenses ratio. These management techniques do not incur hefty fund management fees such as those that characterise active fund managers. This is because the fund managers do not apply active strategies in managing the funds, also noting that strategies could either be fundamental or technical. As a result, index funds tend to be low-cost investment vehicles. Jones (2010) also notes that index funds have outperformed actively managed funds; indeed, over the last 20, years the average large cap actively managed fund has been outperformed by the S&P 500 index on an annual basis due to the low expense ratio. It can be deduced that index funds are the perfect vehicle for long-term investment for a risk-averse investor. Furthermore, Bodie et al. (2011) mention that index funds constitute a low-cost way for small investors to invest in stock without the application of stock analysis.

Diversification of the index funds stems from mimicking indices. These can either be bond indexes or securities indexes. Exchange indices are constituted of a number of equities or a number of bonds, and therefore when a fund mimics an equity index or a bond index, it means the fund invests in all or a sample of the equities or bonds that make up the indices, resulting in diversification.

The tax efficiency of index funds also contributes to their low-cost nature, resulting in higher returns on the funds. Jones (2010) notes that index funds only buy and sell shares when necessary, and this means that the funds do not attract high tax bills – and neither do they attract high transactional costs.

Index funds are a capital markets investment vehicle and are traded in capital markets. The low cost and higher returns associated with of index funds ought to be taken advantage of by investors. Any risk-averse investor who considers investing in index may well find a great opportunity. Index funds have, however, not been introduced into the Kenyan securities exchange (Akama & Jagongo, 2013; CMA, 2016; CMA, 2018).

2.4 Conclusion

This chapter sought to review literature for the purpose of discussing the suitability of introducing index funds in the Kenyan financial capital markets. The discussions suggest that the Kenyan financial sector has grown and developed significantly, and is ready for the introduction of capital markets products in order to deepen the market. The next chapter presents the empirical studies and the principles underlying index funds.

Chapter 3

Empirical studies and the principles underlying index funds

3.1 Introduction

The purpose of this chapter is to review empirical studies with the aim of discussing the principles underlying index funds. The factors required for the introduction of index funds in the NSE are also discussed in order to lay bare the reasoning behind the objectives of the study, which are the assessment of the weak form EMH and the determination as to whether the NSE stock indices are representative of the Kenyan capital market.

The introduction and development of the Efficient Market Hypothesis (EMH) between the 1950's and the 1960's and the consequent introduction of index funds in the 1970's has led to a shift from actively managed funds to passively managed funds. Index funds are passively managed funds that track a given index. The funds offer diversification and are low cost in nature. Index funds can thus be a solution to hefty fees charged by fund managers in the Kenyan capital markets as shown in chapter 1.

Index funds require capital market to follow the Efficient Market Hypothesis (EMH), under this premise, prices adjust to new and correct information as soon as new information is received by the capital markets. As a result, it is not possible to beat the market. The hypothesis, however, assumes that all investors act in a rational manner and this is the reason why prices adjust to new and correct prices immediately when new information is received in the market. Behavioural finance proponents have disputed this, and said that market participants do not always act in a rational manner. The irrationality of participant creates arbitrage opportunities; hence active fund managers can beat the market. Index funds also require the existence of a market representative index and an adequate regulatory framework. It is not clear whether these factors exist in Kenyan capital markets.

This chapter discusses these issues. The chapter unfolds as follows: Section 3.2 explains the concept of indexing. Sub section 3.2.1 discusses passive versus active portfolio management, 3.2.2 criticises mutual fund fees and expenses, 3.2.3 discusses and gives a comparison of active and passive funds. Section 3.4 explores efficient markets as a factor suitable for the introduction of index funds. To this end, 3.4.1. looks at efficient capital markets, 3.4.2 evaluates empirical studies on Efficient Market Hypothesis (EMH), and 3.4.3 discusses Behavioural Finance. Section 3.5 explains market representative stock index as a

factor suitable for the introduction of index funds. Finally, Section 3.6 discusses regulations framework as a factor suitable for the introduction of index funds.

3.2 Indexing

The replication of stock index performance by index funds managers leads the present discussion to the term indexing, which refers to the act of mimicking an index or replicating an index. This is a passive management technique that ensures that a portfolio of securities performs according to the index it mimics. Reilly and Brown (2003) purport that, as the name implies, it involves indexes - not only stock indexes, but bond indexes, sector indexes and international indexes. This suggests that an index funds can be constructed from a variety of indices. Anandu et al. (2020) note that indexing is a passive investment management strategy that tracks an index by holding all of its assets or an automatically selected sample of assets of the index. This implies that indexing is the building up of a portfolio from securities that compose a benchmark index.

The importance of indexing cannot be overestimated. Indexing offers an investor an opportunity to diversify investments, as a result lowering risk. An investor can achieve returns that are similar to a given securities index. Secondly, the low-cost character of the index funds cannot be ignored, because the investor reaps the benefit of the low cost by earning higher returns. Where index funds are available, investors have an alternative investment vehicle apart from actively managed investment opportunities and traditionally managed passive funds.

In pointing out the importance of indexing, Pace et al. (2016) further explain that indexing enables investors to replicate effectively returns of an underlying index, while reserving tracking error to a minimum. In addition, the low-cost nature of indexing was brought to light as Hill (2016) commended the Vanguard 500 index fund as being one of the most important financial innovations as it provides individual investors with a low-cost investment vehicle. Cremers et al. (2016) further note that indexing can improve competition by pushing active managers to pursue differentiated products that deliver alpha to their investors. This implies the creation of competition in the market, and as a result, the development of a market through creating differentiated products and subsequently encouraging efficiencies in the market.

Passively managed funds have become increasingly popular in the recent past. Indeed, Huang et al. (2019) observe that there has been a shift to passive management of funds motivated by low cost of index funds, a trend also noted by Anandu et al. (2018) who point to a shift in the recent past from active management strategies to passive management strategies. This is because of characteristics associated with passive management strategies. Anandu et al. (2018) attribute this development to the emergence of the Efficient Markets Hypothesis (EMH) in the 1950's and 1960's as well as the introduction of the first stock index in the 1970's. This provided a practical application to the hypothesis, the low cost associated with index funds management, and the growing evidence of the underperformance of active funds. As a result, there has been commendable growth of passive funds in the recent past; Cremers et al. (2016) observe that mutual funds have made considerable growth between 2002 and 2010. Much of this growth has been in indexed equity funds in which investors can access the stock market at lower cost and lower risks because of diversification. Similarly, Madhavan (2014) notes that the growth of indexing has been caused by a rising awareness of transactional costs, taxes, lower turnover, and the importance of diversification and informational efficiency of prices.

Consequently, this shift from actively managed funds to passively managed funds has sparked more competition between the active and passive managers. It has, for example, pushed active managers to lower their management fees, introduce more active investment products and make improvements in the fundamental and technical skills in an endeavour to beat the market. Cremers et al. (2016) conclude that this growth has increased competition in the asset management industry by lowering fees charged by active fund managers and increasing investment products.

In addition, the shift from active management strategies to passive management strategies has had unintended consequences. There has been an increase of some risks, for instance market volatility, industry concentration, diminishing liquidity and redemption risks in the capital markets (Anandu et al 2018). The intended consequences, however, are low cost and low-risk because of diversification and higher returns that investors can take advantage of.

From the foregoing discussions it can be concluded that indexing is a passive fund management strategy that is utilised by fund managers to offer investors diverse assets, and a cost-effective investment vehicle. This concept is based on the Efficient Market Hypothesis (EMH) that explains stock or bond prices as a

reflection of the available market information, thus indicating the inability of fund managers who utilise active investment strategies to predict future prices. This points to the importance of EMH. The concept of indexing is also based on the notion that there must be an already existing index or indexes that are representative of the market and that can be utilised to formulate an index fund. The subsequent section presents a discussion of passive management strategies and active management strategies together with reference to empirical studies thereof.

3.2.1 Passive versus active portfolio management with reference to empirical studies

Passive vs active portfolio management strategies have been a source of a never-ending debate for the past 40 years since the introduction of Efficient Markets Hypothesis. Specifically, whether or not the active managers are able to deliver returns that are higher than the benchmark has been the question. Proponents of passive portfolio management strategies have continuously argued that it is impossible to beat the market continuously. On the other hand, proponents of active management strategies have argued that it is possible for an active manager to take advantage of inefficiencies in the market and beat the market.

With these arguments at hand, it is important to understand the terms passive and active portfolio management. Bodie et al. (2010) describe a passive investment strategy as buying a well-diversified portfolio without attempting to search out mispriced securities, and it involves a buy and hold strategy. On the other hand, an active strategy is one that involves identifying undervalued and overvalued stock by means of technical and fundamental analysis in order to beat the market. The major distinctions between passive management and active management are the buy and hold strategy that is used in passive funds management, and the application of skill by active fund managers in order to generate higher returns than the benchmark.

Active fund management has been criticised of its hefty fees charged by active managers as mentioned earlier. These fees may nullify any excess returns that have been made through the technical and fundamental analysis that is applied by active fund managers. Jones and Wermers (2011:42) confirm this by stating in their results that, “active returns (adjusted for risk) across managers and time probably average close to zero, net of fees and other expenses. This finding is what we should expect in a mostly efficient market, in which fierce competition among active managers drives average (net) active risk-adjusted returns toward zero, in equilibrium”. It follows that the efforts of active managers are futile in

cases where returns average to zero net of fees and expenses. Bodie et al. (2010) emphasise this point and adds that the active management of funds generates large brokerage fees without increasing expected performance, yet most investors still hire active managers. Thus, one may assume that it is done out of ignorance or with the hope that the next actively managed investment will result to higher returns.

Passively managed funds outperform actively managed funds. In addition, Burton (2003), in response to criticism of passive management strategies, conclude that high expense ratios of actively managed funds in the US of over 140 basis points cause these funds to underperform their benchmark indices by approximately same amount. These authors also point out that evidence supports the passive management of funds in all markets, in the US as well as in international markets, in small and large capitalisation. Researchers (Walden 2015:160; Rompotis 2013) in examinations of both passively and actively managed funds found that funds that were passively managed outperformed the actively managed funds. Burton (2003) further conclude that there is no predictability that could cause the outperformance of passively managed funds, and investors would achieve higher returns by employing indexing strategy. This finding points to the futility of technical and fundamental analysis. Bodie et al. (2011) provide strong evidence that returns from actively managed equity funds were below the Wilshire index for 23 years of the 39 years between 1971 and 2009.

The above discussion lead us to conclude that passively managed funds mostly outperform actively managed basis on a risk adjusted benchmark. The cause of this phenomenon as seen is the high costs associated with the management of active funds. To understand fees and expenses incurred the next sub section discuss mutual fund fees and expenses and the implications of these fees.

3.2.2 Mutual fund fees and expenses

Mutual fund fees and expenses make a considerable difference on the ultimate returns experienced by an investor. It is therefore important that an investor must be aware of the kind of fees charged by various fund managers and the expenses incurred by the fund. There are fees and expenses that are common to both active and passive funds. Such fees are associated with the benefits of being part of a fund. Scholars (Jones & Wermers, 2011; Bodie et al., 2011) point out that these benefits include bookkeeping and administration, diversification and divisibility, professional management, economies of scale benefits, liquidity custody and optionality. To add to this, the active fund manager charges fees for actively

managing the fund. Jones and Wermer (2011) state that these are costs incurred in the acquisition of information and analysis of information; in other words, applying skill and human capital.

There is a clear distinction between mutual fund fees and expenses. When purchasing shares in a mutual fund, the investor will incur some initial fees. The investor would also incur fees when exchanging securities within the fund as well as when redeeming shares. Scholars (Jones, 2010; Bodie et al., 2011) classify these fees and expenses as those directly paid by the investor and those indirectly paid by the investor. Direct fees include the front-end and back-end sales charges which are also known as front-end load or back-end load. Front-end sales charges are those incurred when the investor is purchasing shares of a fund. This type of fee is typically paid in commission to the broker making the sale. On the other hand, a back-end charge is incurred when exiting a fund. This fee is also referred to as redemption fee. A redemption fee might decrease depending on the number of years the investor invests in the fund and eventually not paid. These authors mention other fees including exchange fees and account management fees. Exchange fees are incurred by the investor when transferring funds within the same fund family and account management fees is incurred for low balance accounts. It is worth noting that mutual funds can be classified into load funds and no-load funds. This implies that one category of funds charges sales fees, and the other category does not charge sales fees (no load funds).

Secondly, there are indirect fees. As a mutual fund operates, it incurs operational expenses. One should take note of the expense ratio (operating fees) which is an indirect fee (Jones, 2010; Bodie et al, 2011). Since these are indirect fees, investors must be keen to identify them at commencement of investment. Jones (2011) explains that the indirect fees include management fees which is the fee charged by professional fund managers who carry out the technical and fundamental analysis, distribution fees (12b-1) which has to do with advertising and marketing. Other expenses such as mail and record-keeping are also included under operational expenses. The authors further advise that a fund may not charge all the operating fees; some maybe waived. With regard to fees and expenses, some mutual funds offer different classes of shares that structured as different levels of fees and expenses, but the classes share one portfolio of securities (Jones, 2011).

Generally, fund management charges vary from fund to fund. There are many types of mutual funds as discussed above, and these types of funds will differ in terms of fees and expenses charged. Khorana et al. (2009) found that mutual fund fees and expense ratio vary depending on a number of factors. Firstly, these authors found that the fees and expenses vary depending on type of fund and fund family. For

instance, larger funds charge lower fees, index funds that are passively managed charge lower fees, as well as guaranteed funds and funds that require higher minimum investment are known for charging lower fees.

Likewise, where the fund is domiciled influences the fees and expenses. Khorana (2009) notes that onshore funds tend to charge lower fees as compared to offshore funds, while onshore funds that are set up by foreign companies tend to charge higher fees. The kind of securities that a fund chooses to invest in will also affect expenses and fees charged. Countries with smaller, older mutual funds, and well-educated citizens tend to charge lower fund management fees.

The regulatory framework will also influence the fees charged by an investment institution. Khorana et. al. (2009) explain that funds in countries with an adequate reliable regulatory framework for capital markets and judicial system that works tend to charge lower fund management fees as compared to countries with poor regulatory frameworks.

The amount of fees charged will inevitably affect final returns of the fund. Active fund managers have been accused of earning excess returns that are equal to the cost of actively managing the funds; in other words, they just earn back their fees (Jones & Wermer, 2011).

Apart from mutual fund fees and expense ratio, there is the matter of tax. Mutual fund performance is affected by taxation requirement of the domicile country of the fund. Tax is charged directly on the investors' returns the investor is ultimately responsible for tax payment. Jones (2010) argues out that shareholders in a mutual fund can end up paying a large proportion of tax regardless of the funds' performance.

In the Kenyan context, different types of tax are charged on different forms of investment returns. Kihara and Owino (2022) explain that a withholding tax of 15% is charged on returns on investments, 5% withholding tax is charged on dividends paid out, and in case an investor invests in 2-year government bearer instruments, a 15% withholding tax is also charged. A 25% withholding tax is charged on other forms of bearer instruments, while interest on housing bonds and bearer bonds of ten years and above attracts 10% withholding tax. However, the infrastructure bond is tax free. These withholding tax are normally deducted by the fund or invested company and remitted to the government and as a result affects final returns. Implying in case of default the investment fund is held liable. This kind of tax payment

requirement from the shareholders is that they cannot control the amount of tax they pay if their investments are managed by fund managers. This is because the fund managers decide when to realise capital gains and losses and not the shareholders themselves (Bodie et al., 2011). The frequent capital gain and capital loss by fund managers increase transactional costs and taxes. In the United States, for example, taxes are charged differently. Jones (2010) and Bodie et al. (2011) point out that mutual funds are granted “pass-through status” under the US tax code, and thus taxes are paid by investors in the funds, and not by the fund itself, as long as the fund distributes all income to shareholders.

The discussions in this section suggest that the major differences between active and passive fund management are the application of technical and fundamental techniques used by active managers. The increase of the expense ratio as a result of the application of these techniques is another difference, and so is the effect of active management activities on returns. Tax and transaction costs are further differences. These three aspects that increase fees, taxation and expense ratio in the long run affect the returns of both actively and passively managed funds. The performance of actively managed funds has, however, been found wanting as discussed in the next section. For this reason, a low-cost fund that provides an investor with higher return is recommended and this would certainly depend on the efficiency of the market.

3.2.3 Active funds versus passive funds with reference to empirical studies

The empirical results on active funds’ performance versus index funds’ performance shades light on returns on both funds and whether it is worthwhile for the retail investor to invest in either. In this section, evidence is given on the performance of active and passive funds in different regions of the World.

Indices’ performance outweighs active funds’ performance: Cresson et al. (2002:1) note that, “most published reports of fund performance indicate that the indexes typically outperform managed funds most years by a wide margin”. This is mainly due to fees charged by active fund managers. Huang et al. (2019) comment that the higher performance by index funds is attributed to high management fees charged by active managers. As discussed earlier actively managed funds have higher expense ratios and trading costs, due to additional costs associated with skill that is applied by the fund managers. Crane and Crotty (2018) in their investigation of the US active and passive fund performance (setting out to determine whether these funds have skill), concluded that the best of active funds are insufficient to

warrant investment in the active fund. Index funds outperformed the active funds for both alphas and t statistics under a variety of benchmarks. This provides further proof of the futility of active management in an efficient market. The developed capital markets are assumed to be at least weak form efficient. In addition, there has been a shift to index funds and exchange traded funds due to evidence of active funds under performance. Crane and Crotty (2018) conclude that, “Stochastic dominance tests suggest that no risk averse investor should choose a random active fund over a random index”.

In studies done in the USA and Europe, similar results of passive funds outperforming active funds were found. Returns of active funds before management fees are deducted indicate that the returns are similar. Accounting for management fees affects returns negatively. A study by Pace et al. (2016) where US and European mutual funds and electronic traded funds (ETFs) were studied in an examination of NAVs over a ten-year horizon, found that the risk-adjusted returns for active and index replication were equivalent. High fees charged by active fund managers, however, revoked any form of active funds’ performance. The results advise investors to be more concerned with the house’s expense ratio and transactional costs. The investor should thus invest in low-cost index trackers.

In a different vein, efficiency of the international markets; that is markets outside the USA has been questioned. Fortin (2005), in an empirical study on active international mutual fund management, found that it was beneficial to select international active mutual funds over index funds. These results imply that international active mutual funds outperform international index funds, therefore questioning the efficiency of international markets in comparison to the US market. On the other hand, bond index mutual funds returns and risk-adjusted returns are significantly higher than bond category averages. The expense ratios of bond index mutual funds are much lower than bond category averages (Chang & Krueger, 2011).

In European market Turkey to be specific, active funds have been found to beat the market further before fees not only questioning the efficiency of the market but confirming that active fund managers fees erode investors returns. Gokcen and Yalcin (2015) conclude that in the emerging market Turkey, the average active fund beats its benchmark by 26 basis points before fees and passive funds outperform active funds after fees. This may be suggesting that the active management fees are high in emerging market Turkey. Gokcen and Yalcin (2015) add that few active fund managers were able to repeat their success and they displayed herding behaviour in asset allocation decisions in fear of underperforming.

Hence, the authors (2015) conclude that, in cases where active funds outperform the benchmark, fund managers were unable to repeat their success. Index funds are thus a crucial need in Turkey's financial markets. This implies that if active funds outperform their benchmarks, it may be ascribed to luck and does not suggest the application of skill on the part of an active manager. Similarly, in New Zealand, active funds in the period of 2010 to 2017 could not provide any evidence of outperformance and stock-picking skill in these funds. Investors in New Zealand were advised to be wary of self-proclaimed investment skills and fees charged higher than those charged by passive managers (Frijns & Indriawan, 2018).

Asian funds display similar results where passive funds outperform active funds. Chung et al. (2017), in an evaluation of the performance and performance persistently of actively and passively managed domestic equity funds of Korea's National Pension Service, found that index funds outperformed active funds. This implies the efficiency of the Korean market and again points to the futility of active fund management. A study done in India shows that, on average, active funds record 0.18% lower returns as compared to passive funds (Narasimnah & Shah, 2015). This justifies the notion that accounting for fees reduces returns. This is the case because 0.18% is a minimal difference and it implies that returns were similar. Che and Rui (2017) concur, giving evidence from the Chinese market that recommended passive funds are a better choice in investment. It follows that given all this information, it makes little sense to buy and sell securities frequently. According to Bodie et al. (2010), frequent selling of securities generates large brokerage fees without increasing expected performance, yet most investors still hire active managers.

There are proponents of active fund management who argue that passive and active funds equally underperform their relevant indices, net of fees. This argument is echoed by Jones and Wermer (2011) who argue that both active and passive managers charge a fee for normal activities involved in managing a fund these activities include bookkeeping expenses, diversification expenses, liquidity custody expenses and others. These expenses alone attract a fee that causes both active and passive funds to underperform their relevant benchmark indices. The authors thus point out that the funds should not be compared to index benchmarks but to an equal relevant passive fund.

However, in addition to the normal expenses, active funds incur more expenses because of the technical and fundamental skills applied to manage the funds and transactional costs. Therefore, this causes the

active funds to underperform more. Jones and Wermer's (2011) argument is thus disputed by the fact that there are far too many results that are contrary to their argument. It has been found that in most efficient markets, active funds underperform in terms of their benchmark indices, while passive funds outperform their benchmark indices. Jones (2010) provides details on the performance of actively managed mutual funds versus benchmarked index funds, noting that for the last 20 years ending in 2003, the S&P 500 index funds outperformed 90% of large capitalisation equity funds in the US. For the same period, the average equity fund was outperformed by the Vanguard S&P 500 Index Fund. For the period 1996-1999, the top 20 equity mutual funds with returns of 50% higher than an index fund during the period all reported negative returns three times worse than the market over the next four-year period.

With this in mind, investors still seem to search for active managers to manage their funds. Does this mean that investors are irrational and somehow hope that there is some level of inefficiency in the market that can be taken advantage of to beat the market? The EMH exposes the failures of active portfolio managers. Bodie et al. (2011:393) in their discussions comment that, "if the EMH is entirely correct then the active managers should not be working at all". Does this mean that active portfolio management is a complete failure and does not contribute to the financial markets?

The assumption by investors of some level of inefficiencies is indeed a sound thing. Jones and Wermer (2011) argue out that for markets to work well, some level of inefficiency is required. This inefficiency assumption by investors results in active managers seeking costlier information that, in turn, cause further fair pricing of financial instruments, thus increasing efficiency in the market. It follows that active fund managers remain relevant in facilitating the fair allocation of capital within the financial markets that, in return, increases economic growth and competition in the financial markets. Jones (2010) points out, however, that it is paradoxical to suggest that active investors' activities aid in market efficiency.

Active fund managers do, nonetheless, have a role to play in efficient markets. Bodie et al. (2011) identify many roles of active fund managers in an efficient market. One of these roles is diversification. The active fund manager's role is to help an investor to diversify assets to minimise unsystematic risk. An active fund manager is obligated to advise the investor to invest according to their risk preferences and to offer an investment policy that is preferable according to their ages and risk profile. Minimisation of tax implications through security choice is another responsibility of a fund manager. For the sake of argument, it is important to remember that active managers contribute to the efficiency of financial markets. Jones (2010) feels that this is a paradox of efficient markets and active fund managers in that,

as active managers seek out information and buyers and sellers act upon the information, prices adjust themselves accordingly. These activities of active fund managers result in market efficiency. In this sense, active fund managers play a very important role in the market.

From these discussions, it is clear that index funds and active funds are two distinct types of funds. Index funds track indices that are benchmarked to performance, and the funds are passively managed. On the other hand, active funds are managed more actively by utilising fund managers' skills. The application of skill in active fund management calls for higher management fees. It is also argued that, in addition to inability of fund managers to beat benchmarks due to the efficient markets' hypothesis, high management fees are a contributor of lower returns characterised by active funds. In addition, in the case where active funds outperform index funds, it is not possible for active managers to repeat the results. In spite of this, active managers are important to financial markets because they contribute to fair pricing and adequate capital allocation.

In conclusion, it is clear that index funds perform better than active funds. Since its introduction there has been a shift from active to passive fund management strategies. Hence the consideration for the introduction of index funds to the Kenyan market. For index funds to exist, indices that represent the capital markets are required. Index funds track indices which are the benchmark for performance. Another crucial factor is the efficiency of the capital markets that index funds require for operation. Thus, the concepts of efficient capital markets, market representative indices and the Efficient Market Hypothesis are discussed below.

3.3 Efficient market as a factor suitable for the introduction of index funds

3.3.1 Efficient capital markets

An efficient market is important to the players in the market. It has certain attributes or characteristics that define it. The characteristics of an efficient markets are discussed by Reilly and Brown (2003:106), as;

“that which has adequate information that enables participants to determine the right price. It has the ability to sell and buy an asset fast at a known price which is liquidity or marketability. It has continuity and depth, that is, the potential of many participants to trade at a price above or below

the current market price, transaction costs should be low, and lastly, that the market price should reflect all available information in the market”.

To further illuminate the value of efficiency in a given market, Arnold (2013) points out that efficiency is valuable to a stock market because efficiency encourages investors to invest in private enterprise. Investors need to be assured that the stock they are purchasing is at a fair price and of its ability to be sold at a fair price in the future, it's a 'fair game'. The correct share pricing as a result of an efficient market can provide accurate information to firm managers, thus enabling the firm to strategise correctly for the purpose of wealth maximisation. Also, Arnold (2013) emphasizes that the purpose of a firm is the maximisation of wealth for its shareholders. In addition, firm managers need to know correct rate of return they are expected to obtain, correctly priced stock therefore encourage correct rate of return for a particular risk class. Operating efficiency and pricing efficiency assist in efficient resource allocation. Furthermore, when stocks are priced correctly, investors' funds are allocated appropriately in the market.

There are many forms of efficiency in a given market. Arnold (2013) discusses three types of efficiency, beginning with operational efficiency, which refers to the speed, cost, and reliability of transactions on a given market. Operational efficiency is created through healthy competition within the market participants. Allocation efficiency is the second form of efficiency that the writer explains, and has to do with allocating resources to where the resource can be efficiently utilised for more productivity. Economic players need channels that allocate funds their way, the stock markets for instance assist in the allocation of funds to competing real investments. The third form of efficiency is the pricing efficiency, and this is the focus of EMH: “In a pricing efficient market, the investor can expect to earn merely a risk adjusted return from an investment as prices move instantaneously and in unbiased manner to any news” (Arnold, 2013:545). Fama, in his 1988 paper formalised the three levels of EMH that are concerned with pricing efficiency, as discussed in Chapter Three of this study.

An efficient market is one in which prices of commodities, services or securities are fair, in the sense that they reflect available information. Burton (2003) define market efficiency as the ability to reflect information about individual stocks or financial markets in the market prices. Thus, if this is the case due changes in information, markets prices are constantly reacting to such information. Brown (2020) further

defines an efficient market as one in which security prices adjust rapidly to the arrival of new information, and therefore, the current prices of securities reflect all information about the security.

The Efficient Market Hypothesis therefore has to do with changes in prices as new information is received in the market. Arnold (2013) expands that the Efficient Market Hypothesis (EMH) implies that if new information is revealed, it will be absorbed into the share quickly and in a rational manner, with respect to the share price movement and the magnitude of that movement. It is further pointed out that market efficiency does not mean that share prices are equal to true value at every point in time, but rather that errors made in pricing are unbiased. Price deviations from the true value are therefore random. The author adds that any trader would only make a fair return and not an abnormal return. Therefore, an efficient capital market is one in which prices react to information received from the environment to form new prices. It is the ability of information to be absorbed into prices, implying that abnormal profits cannot be realised through the prediction of price movements. Jordan (2009) further explain that, if the market cannot be beaten, then that market is said to be efficient. As a result, the ability of an investment to earn consistently excess returns as compared to other investments of the same risk levels is not possible, and it is referred to as beating the market.

The implication that in an efficient capital market it is impossible to beat the market consistently has received criticism. Bodie et al. (2010) point out that investors have the motivation to spend resources in search of information that will enable them to beat the market. The authors concur with this argument to some extent, and likewise point out that in emerging markets where structural inefficiencies exist which result to capital markets inefficiencies, this may be true. However, in developed and efficient markets, the search for information only increases competition, which results in capital markets' efficiency.

From the foregoing discussion, one of the implications that arises is how portfolios should be managed whether it is futile to apply either technical or fundamental analysis to beat the market. Jordan (2009) purport that a buy and hold strategy of portfolio management is recommended, since the active management of portfolio seems futile. If markets are efficient, timing the market is a moot point, and thus hefty fund management fees should not be paid since the managers play an insignificant role. It follows that a buy and hold strategy involving broad market indices is extremely difficult to outperform, as discussed in the previous sections. Market efficiency therefore advocates for passive investment

strategies which include indexing (Jordan, 2009). In the foregoing discussions, market efficiency was introduced and it is recommended that in an efficient market, a buy and hold strategy should be used. In the next Section, market efficiency studies that have been carried out are perused, together with a number of their outcomes and implications.

3.3.2 Empirical studies on the Efficient Market Hypothesis (EMH)

Capital market efficiency has been tested in developed, developing and emerging markets with varying results and varying implications. Seth and Sharma (2015) investigated the weak form stock market efficiency, and integration of select Asian and US stock markets in consideration of the recent financial crisis, in order to observe whether diversification is lucrative. The results proved that the markets were not weak form market efficient, therefore creating chances of earning abnormal returns on investment. Hence, these results had practical implications on management of portfolios by fund managers. For instance, a reduction of diversification in the markets was encouraged due to correlations and co-integration in the investigated stock markets, and active fund management was also encouraged (Seth & Sharma 2015).

Tests of EMH have also been conducted on Asian markets with varying results on the efficiency of the markets. Morales and O'Callaghan (2018) conducted an empirical study of six East Asian economies on market efficiency during the Asian financial crisis and the global financial crisis. The results showed market inefficiencies except for the South Korean and Hong-Kong capital stock markets. Thus, the results suggested the need for further reform and advances to increase transparency by quickening the development of legal and information system that aid the process of price discoveries.

EMH studies have been conducted for developing economies as well. Market informational inefficiencies was evident more in the developing economies than the developed economies. Nwachukwu and Shitta (2013) investigated the relationship between current and historical prices in developing economies and whether they conform to the weak form EMH by comparing 24 emerging and nine industrialised stock market indices. Turn of the year effect for these stock markets was also investigated. Two thirds of emerging markets stock price changes were correlated as compared to a third of the industrialised stock markets stock price changes. Turn of the calendar year effect was present in

half of the emerging stock markets and only one third of the developed stock markets. These results were important to foreign investors' risk diversification strategies.

Tests of market efficiency have been conducted in Europe and the middle East with diverse results. Dragota and Tilica (2013) tested the predictability of returns for 20 East European former communist countries for the period of January 2008 to December 2010, to establish the level of efficiency of the stock markets. Doubts about market efficiency of all the countries in the analysed periods were raised. Dragota and Tilica (2013) advised that active management strategy should be applied for these capital markets with caution, due to a lack of liquidity which can be a hindrance to the active strategy. The authors note that, "Higher levels of market efficiency imply use of passive management strategies while lower levels of efficiency imply the use of active management strategies" (Dragota & Tilica 2013). This implies that market inefficiencies in Europe and the Middle East capital markets would result to abnormal returns. Ananzeh (2014) analysed the Amman stock market return for the period January 2000 to December 2013 to test weak form efficiency. The results proved the weak form inefficiency of the Amman stock market (ASE).

EMH has also been studied in the African continent, but these studies are scant and it has been advised that more studies be conducted, using more robust methods. The studies that are available mostly show informational inefficiencies in AEMs. Ntim et al. (2011) examined 24 African continent-wide stock price indices and eight individual African national stock price indices for weak form efficiency. The results indicate that African continent-wide stock price indices had better informational weak form efficiency as compared to the national stock price indices. The results also implied that the African stock price discovery process can be improved with proper integration of the African stock markets eventually resulting to economic growth. In another study, Biekpe (2007) tested ten African stock markets for the weak form market efficiency. The Namibian stock exchange was found to be weak form efficient, and this was attributed to its correlation with the Johannesburg stock exchange (JSE). Kenya and Zimbabwe were also found to be weak form efficient (Biekpe 2007). The rest of the markets were found to be weak form inefficient.

Choice of methodology has been found to be important depending on the nature of data and the generation process of the data. Methodology heavily influences results. Empirical studies by Abakah et

al. (2018) set out to re-examine 5 African stock markets: South Africa, Nigeria, Egypt, Ghana and Mauritius, using different tests to assess non-linearity effect and thin trading which are prevalent in Africa. Weekly returns of the stock market data for the period 2000 to 2013 were obtained, and non-linear Fourier unit root test was used to account for non-linearity of the data, unknown structural breaks and unknown functional forms. Abakah et al. (2018) note that the results suggest that non-linearity and thin trading effects influence markets' inefficiency tests; it was concluded that the methodology used in such studies have a bearing on results. Phiri (2015) concurs with Abakah et al. (2015) in that methodology affects efficient market results. As a result, this study used linear and non-linear models in the analysis of the data. Abakah et al. (2018) conclude that only Egypt and South Africa were found to be efficient when adjustments for thin trading and non-linearity are done. Phiri (2015) investigated the weak form EMH for five generalised stock indices for the Johannesburg stock exchange (JSE) where tests for correlation using linear and non-linear unit root tests were utilised. It was found that under linear tests, the JSE was market efficient and under nonlinear unit root tests, the majority of the indices violated the weak form EMH. Furthermore, the EMH was rejected in the secondary sector while the primary sector indices were found to be weak form efficient. The market participants were therefore advised that the secondary sector stock prices could be exploited using technical analysis hence active portfolio management (Phiri, 2015).

It may be inferred from these studies that the data generating process is an indication of the kind of methodology that should be utilised. It is also suggested from the above discussions that the efficiency or lack of it in a market informs the fund management style that is adopted within the market. For example, Katabi and Raphael (2018) examined empirical evidence for the Efficient Market Hypothesis (EMH) in the Dar es Salaam (DSE) stock exchange. The results proved that the DSE did not behave randomly, and technical analysis as a portfolio management strategy was recommended (Katabi & Raphael, 2018). This is a further indication that efficiency of capital markets informs the portfolio management strategy to be used. Njuguna (2016) tested the weak form efficiency for the Nairobi Securities Exchange, using data from both the NSE 20 share index and the NSE All Share Index for the period February 2008 to January 2015. The results indicated that NSE and ASI daily and weekly data were not weak form efficient (Njuguna, 2016). These results were an indication of implementation of active management strategy within the Kenyan capital markets.

Further studies suggest that integration of markets can realise market efficiencies. The Namibian stock exchange was tested for weak form efficiency by Sheefeni (2016). The Namibia stock exchange was found to be weak form efficient, and this was attributed to its correlation to the JSE as a dual listing on both stock markets (Sheefeni, 2016). A recommendation was consequently made for passive management strategies and the development of the Namibian financial markets for creation of investment opportunities that would reduce capital outflow. This will result to retaining funds in the country and addressing issues of thin trading (Sheefeni, 2016). This situation demonstrates that the dual listing of an exchange can boost the efficiency of a given market. Thus, integrating capital markets can bring about informational efficiency of stock markets.

Empirical studies on EMH have been widely conducted, with varying results and implications. Results on whether an exchange market is efficient or not efficient has implications on how portfolios should be managed. Studies suggest that where efficiency (as described by the EMH) of the markets is not found, active management strategies should be applied. However, where efficiency of exchange market is present, passive management strategies should be applied. The results also have implications for diversification by investors. Integration of capital markets is also implied where there are market inefficiencies. It is noted that informational efficiency results from integration of capital markets. Inefficiency in capital markets show that the market needs further reformation and development through policy formulation, amendments and implementation.

3.3.2.1 Research Gap

The methodology used clearly affects the results, and thus robust methods should be used and previous research revisited while taking into account the non-linearity of data and the thin trading characteristics of stock markets in developing regions. It must be noted that Njuguna (2016) did not consider non-linear data generating process evidenced in AEMs. Methodology used by Njuguna (2016) presents a research gap for this study.

Secondly, the NSE is an AEMs therefore studies on EMH of the NSE are scanty as indicated in both Chapter One and this Section. Also, empirical studies on the introduction of index funds to the Kenyan capital markets are very scanty as shown in the discussions. Akama and Jagongo, (2013) researched on

the introduction of index funds in the Kenyan capital markets. The researchers however utilised qualitative research and did not consider the utilisation of robust statistical methods to study the market.

In consideration of these gaps this study utilised both linear and non-linear unit root tests in examining the EMH of the NSE indices. The study also assessed the market representativeness of the NSE indices through the use of robust statistical methodology. The study therefore made a contribution to the existing literature and provided a framework for the introduction of the index funds.

Table 3.1 Similar studies and tests utilised for EMH

Author	Year	Objective	Data	Tests
Andrew Phiri	2015	Investigate the weak form EMH for five generalised stock indices in JSE	Weekly indices data from five stock indices	<ul style="list-style-type: none"> • Linear unit root tests -Augmented Dickey Fuller (ADF), -Philips-Peron (PP) test • Non-linear unit root tests -Threshold Autoregressive models (TAR)
Jacinta Chikaodi Nwachukwu and Omowunmi Shitta	2013	Testing the weak form efficiency of stock market; comparative study of emerging & industrialised economies	Monthly stock returns	<ul style="list-style-type: none"> • Auto correlation
Neha Seth and A. K. Sharma	2015	Examine the information efficiency and integration simultaneously for Asian and US stock market while considering the impact of recent financial crisis	Daily stock market data	<ul style="list-style-type: none"> • Runs test • Unit root tests -Augmented Dickey Fuller (ADF) -Philip Perron (PP) • GARCH

				<ul style="list-style-type: none"> • Johansen's Co integration tests • Engle Granger tests
Victor Dragota, Elena Valentina Tilica	2013	To test predictability of returns based on past records for market index of 20 East European Communist Countries	Stock returns of all 20 exchanges	<ul style="list-style-type: none"> • Auto correlation • Unit root tests • Variance ratio • Runs test
Priyanka Das	2020	Testing weak form efficiency evidence from National Stock Exchange of India	Stock returns	<ul style="list-style-type: none"> • Kolmogorov-Smirnov goodness of fit (K_S) test • Augmented Dickey Fuller (ADF) • Philips-Peron (PP) test • Runs test • Variance ratio
Izz Eddien, N. Ananzeh	2014	Testing efficiency of the Amman Stock Market (ASE) returns at the weak form efficient by using daily observations of the Amman Stock Exchange	Daily stock returns	<ul style="list-style-type: none"> • Auto correlation • Runs test • Unit root tests -Augmented Dickey Fuller (ADF) -Philips-Peron (PP) test
C. G. Ntim, K.K. Opong, & J. F.S. Dewotor	2011	Investigate 24 African continent-wide price indices and 8 individual national stock price indices	Returns of all 24 African continent-wide stock price indices and eight individual	<ul style="list-style-type: none"> • Variance ratio test based on ranks and signs

			national stock price indices	
J.A. Abakah, P. Alagidede, L. Mensah, K. Ohne-Asare	2018	To examine weak form efficiency of five African stock markets	Weekly stock returns	<ul style="list-style-type: none"> • Nonlinear unit root test -Fourier unit root tests
Nicholas Biekpe	2007	Study weak form efficiency of ten African stock markets	Daily closing stock prices	<ul style="list-style-type: none"> • Serial correlation • Runs test
Gwahula Raphael, Maximillian M. Katabi	2018	<p>An empirical analysis of weak form efficiency of Dar es Salaam stock exchange</p> <p>Determine empirical evidence of day of the week effect</p> <p>Determine the empirical evidence for month of the year effect</p>	Daily stock returns	<ul style="list-style-type: none"> • Serial correlation test • The Lyung Jung test • Unit root tests -Augmented Dickey Fuller (ADF) -Philips-Peron (PP) test Runs test • Variance ratio test
Josphine Njuguna	2016	Testing the weak form of the Efficient Market Hypothesis (EMH) of the NSE	Daily and weekly index data from the NSE 20 share index	<ul style="list-style-type: none"> • Serial correlation • Unit root -Augmented Dickey Fuller (ADF) -Philips-Peron (PP) test • Runs test

Table 3.1 above presents similar studies and tests that were utilised in examining the data. This study utilised similar tests as expounded in the Methodology Section.

3.3.3 Behavioural finance- critic of the EMH

The introduction of index funds is based on the EMH, yet the behavioural finance school has critiqued the EMH. This subsection examines the behavioural finance criticism of the EMH and whether it is valid and hence can hinder the introduction of index funds in the Kenyan capital markets.

Traditionally, financial thinking assumes that individuals act rationally, and that finance-related decisions are made in a rational manner. Indeed, the EMH holds the position that participants in financial matters act in a rational manner, and thus potential irrationality among individual investors and analysts is not considered by the EMH. This position has received a great deal of criticism from behavioural finance proponents. The argument from these finance proponents is that human beings, when faced with decision-making, may act irrationally based on their psychological and behavioural biases. Bodie et al. (2011) emphatically state that the behavioural finance begins with the assumption that investors might not always be rational; sometimes, they may well behave in a manner suggesting irrationality in their decision-making. This school of behavioural finance is becoming increasingly popular and widely accepted. Bodie et al. (2011) purport that academics are increasingly in favour of behavioural finance, which suggests an acceptance that investors' irrationality and psychological biases may cause prices to move from one level to another, and thus the EMH may not always be correct. This proves that behavioural finance is an important component that should not be ignored.

Consequently, situations that cannot be explained by rational behaviour arise. Jones (2010) states that the behaviourists argue that anomalies that result from human behaviour and psychological biases have been noted in the movements of asset prices. Scholars (Jones, 2010; Reilly & Brown, 2009; Bodie et al., 2011) propound that this does not, however, mean that these irrational decisions make the capital market inefficient, but decisions bring about anomalies within the capital markets. Thus, these anomalies might seem to present profit opportunities. That need not be the case, as Bodie et al. (2011) argue, and if such anomalies presented profit opportunities, arbitrageurs could take advantage and beat the market consistently. However, this is not the case, because their arbitrage actions are limited. As a result, they might not be able to push prices to reflect their intrinsic value. If these limits are correct, then absence of profit opportunities does not mean that markets are efficient either, and as the authors note, neither can be beating the market be consistent because of these limitations. In short, anomalies do not imply an efficient or inefficient market. However, Jones (2010) points out that Eugene Fama, a leading proponent of EMH, has presented arguments against the behaviourist view and their claims that anomalies have

been found in historical asset pricing. The anomalies include size effect, P/E ratio effect, book-value-market value ratio, neglected firms' effect. These anomalies are discussed in Chapter Three of the present study.

Behavioural finance began to question the rationality of investors as suggested by traditional finance proponents. Jones (2010) indicates that behavioural finance originated with Tversky and Kahneman's work in 1979 when they offered an alternative to the expected utility theory underlying traditional rational financial decision-making. The contributions and importance of the work of the behavioural school of finance was recognised in 2002. The Nobel Prize in Economics was awarded to Daniel Kahneman, a Princeton psychologist, and Vernon Smith of George Mason University. Apart from these, other academicians as mentioned earlier, have recognised the contributions of behavioural finance. Jones (2010) identifies the recognition of contributions of this school by Burton Malkiel, a proponent of EMH, who dedicated a chapter in the 9th edition of his book 'A Random Walk Down Wall Street' to the good contribution of behavioural finance.

Apart from market anomalies the irrationalities bring about informational processing errors that affect returns. Scholars (Jones, 2010; Bodie et al., 2011) emphasise the behavioural biases can cause investors to misestimate returns, and can have a bearing on how investors deal with risk vs return and how they make risk-return trade-offs.

One of the informational processing errors that investors make is the overconfidence error. Investors might think too highly of themselves and thus too highly of their skills – to the extent that they trade more than the average investor and make investment decisions that jeopardise returns as well as capital. A number of scholars (Reilly & Brown 2009; Jones, 2010; Bodie et al., 2011) note that overconfidence results in the overestimation of growth rates for growth companies, as well as an overemphasis on good news while ignoring negative news. These lead to poor investment performance. Constant trading may lead to higher transactional costs and incurring more losses, resulting in lower returns than those of a passive strategist. These authors (Reilly & Brown 2009; Jones, 2010; Bodie et al., 2011) concur that research has found that trading activities are highly predictive of poor investment performance. It is, therefore, not a result of market inefficiencies, but of behavioural influence.

Overconfidence may also lead to representativeness bias. Bodie et al. (2011) explains this as where an investor takes a very small sample and assumes that this sample is representative of the whole population. Bad decisions arise from such practice. Bodie et al. (2011: 383) add that, “they [investors] may therefore infer a pattern too quickly based on a small sample and extrapolate apparent trends too far into the future”. The representative bias may cause an overreaction within the market and subsequent correction of anomalies (Bodie et al., 2011). Representativeness also results in confirmation bias. This is where investors look for information to support their stance (Bodie et al., 2011). These authors likewise mention the self-attribution bias and hindsight bias as a result of overconfidence. Self-attribution arises when investors do not take responsibility for any losses incurred but blame the losses on bad luck. Hindsight bias arises when an event occurs, and analysts believe that they had predicted the event.

Forecasting errors is another example of information processing error. According to Bodie et al (2011), forecast error arises from memory bias. This is where an analyst makes a decision based on recent performance of a security or an asset ignoring past performances of the asset. Thus, the buyer seems to select what to remember. P/E ratios anomalies arise from this kind of error (Bodie et al., 2011).

Conservatism is another psychological aspect. Jones (2010) defines conservatism as a phenomenon where investors hold on to their beliefs concerning a particular security for too long despite new information. This leads to lags in the market hence creation of momentum in stock market returns (Jones, 2010).

Framing is one of the behavioural biases that face investors when making a decision. An investor may choose to make a loss over making a gain based on how the investment opportunity has been presented to him or her (Jones, 2010; Bodie et al., 2011). Mental accounting is an example of framing. For instance, an investor may take risk while investing in a mutual fund but would choose not to take any risk while investing in a child’s education fund (Bodie et al., 2011).

Loss aversion is another behavioural bias that is related to framing. Loss aversion entails that it is more likely for an investor to be willing to sell securities that are making gains than selling stocks that are making losses. Jones (2010) explains that loss aversion refers to the tendency among investors to avoid losses as opposed to achieving an equivalent number of gains.

Regret avoidance is a strong behavioural bias that is experienced by individual and institutional investors. Bodie et al. (2011) explain that in this scenario, investors are more likely to regret a decision that incurs losses if the decision was unconventional. As a result, this behavioural bias may hinder some investors in investing in good opportunities that are more profitable. For instance, an investor will harbour more regret if he or she invests in a small unknown venture and incurs losses than when losses were incurred from investing in a well-known firm.

Lastly, there is the common herding effect. Jones (2010) explains the herding effect as a behavioural bias where investors move in one direction as a group, and they tend to buy or sell a security at the same time thus affecting the price of the security.

At this point, it is important to mention the overreaction hypothesis. According to Jones (2010), this hypothesis was tested by DeBondt and Thaler. It states that, “people over-react to unexpected and dramatic news events. As applied to stock prices, the hypothesis states that as a result of overreaction, “loser” portfolios outperform the market after their formation” (Jones 2010: 319). DeBondt and Thaler note that these overreactions affect stock prices, and rational investors realise this mistake and take action. On the other hand, according to Jones (2010), there might be an under-reaction by investors, resulting in undervaluation of a stock. Upon realisation of this mistake, investors take action to reverse the stock back to its intrinsic value.

In response to the overreaction hypothesis David Dreman took a contrarian investment stance. Jones (2010) states that contrarian investment stance is simply taking a position that is not popular at the moment, a position that is contrary to the rest of the investors. This contrarian position can be applied where the herding effect is taking place for better results in the financial market.

Psychological and behavioural biases, according to behaviourists, lead to irrational decisions that affect prices in the market and general trend in the market. A good example is the economic bubbles that have occurred over the years. Bodie et al. (2011) illustrate the events of the dotcom bubble, and how overconfidence bias fuelled the dotcom boom. Two and a half years after the boom, the NASDAQ index prices fell to less than a quarter of the peak value it had reached. Despite these effects of irrational behaviour that create what seems to be arbitrage opportunities, the limits of arbitrage activities might

hinder making profits out of the profit opportunities presented by anomalies that result from irrationalities. Bodie et al. (2011) comment that having in mind behaviourists' argument, failure of active managers to consistently beat the market does not imply that markets are efficient.

3.3.3.1 Behavioural finance and introduction of index funds

Behavioural finance has been at the forefront in its critique of the EMH. Since the introduction of index funds is heavily based on the EMH, the behavioural finance critique must be evaluated and explained. The stance of the Behavioural finance is that investors do not always behave in a rational manner. This stance has however been found to be unstructured. In an evaluation of the behavioural critique, Bodie et al. (2011) propound that the behavioural approach is rather unstructured, because it allows any anomaly to be explained by a number of behavioural biases. There needs to be consistency in explanations of anomalies from the behaviourists. This suggests a lack of substantive evidence to behaviourists' explanations. In addition, the authors question the existence of these anomalies, because the evidence for the anomalies is inconsistent and they also question whether the stock prices are indeed affected by these irrationalities.

In conclusion, behaviourists' suggestions of the irrational effects on investment decision-making leads us to believe that mistakes are inevitable during trading in financial markets even for professional investors. Bodie et al. (2011) suggest that due to these errors that may arise, it is only prudent to pursue a passive investment strategy specifically an indexed passive investment strategy. Thus, it is important for any financial market, including the Kenyan market, to have index funds as an alternative investment vehicle. This leads the discussion to the objective of the present study, which is to assess the suitability of introducing index funds to Kenya.

3.4 Market representative stock index as a factor suitable for the introduction of index funds

Cuthbertson and Dirk (2008:78) explain that, "Index funds are closely designed to closely track a particular index such as the S&P 500, the Wilshire 5,000 index or the US Small Cap Index as well as indices of foreign stocks". In addition, this study adapted the definition (Brown and Reilly, 2009; Saunders and Cornett, 2009; Bodie et al., 2010) that index funds (also known as passive funds) are capital markets' financial instrument that match or replicate the performance of a stock index. This means that fund managers buy securities that are the exact composition of a stock index or invest in a sample of stock that mimic the stock index. Therefore, an index fund attempts to provide similar or identical returns

to those computed by a specified market index. This notion gives rise to the idea that, for an index fund to be available, a market representative index that fairly measures and represents market performance must also be in place. Brown and Reilly (2009) list the uses of market indexes as follows: developing index funds and other index-based products; computing total returns, and risk measures for an aggregate market. Furthermore, the uses include examining the factors that influence aggregate security price movements. Indices are also used by technicians who believe in studying index prices to predict the future price movements, and indices are used as a proxy for the market portfolio of risky assets.

In this study, the focus is on the use of stock indices in the construction of index funds, and also to determine whether the stock indices are market representative for the introduction of index funds. (Akama & Jagongo, 2013; Brown & Reilly, 2009; Kevin, 2009; Nagarajan & Jayabal, 2011, Saunders & Cornett, 2009). In earlier discussions it was pointed out that index funds require a market representative index to function. Akama and Jagongo (2013) note that index funds are tailored to a market representative index. However, these authors caution against introducing an index fund in Kenya. This is because the NSE 20 share index and the AIG 27 share index that were in operation in the Nairobi Securities Exchange (NSE) at the time were not seen as being market representative. This points to the need for a market representative index.

Osoro and Jagongo (2013) add that the market performance representation of the NSE 20 share index has been criticised for being biased, because its sample comprises 20 large companies that are already established out of 62 companies that were listed in the NSE. The sample companies weighted equally in the index, despite their differences in market capitalisation, therefore questioning the market representation of the index.

Brown and Reilly (2009) describes an equal weighted index as one that all stock carry equal weight regardless of their market value. The main weakness of the index is its weak correlation with the underlying share price movements (Osoro & Jagongo 2013). This study therefore seeks to determine whether the indices that are now in operation within the NSE are market representative, by analysing their performance with market performance as measured by the (NASI). Changes have been made to the NSE, and more indices have been introduced to the NSE – and hence the present study. A brief discussion of the Nairobi Security Exchange (NSE) follows below.

The Nairobi Securities Exchange is a Bourse that is based in Kenya (NSE, 2021). The NSE is a leading African Exchange that was founded in 1954 under the Societies Act, and in 2014 the Bourse was demutualised and self-listed. The exchange is a full member of the World Federation of Exchange (WFE) and a founder member of the African Securities Exchange Association (ASEA) and the East African Exchange Association (EASEA). The NSE operated as a regional market in East Africa by 1968, but due to changes in the political regime, the companies domiciled in Tanzania and Uganda were delisted from the NSE. In 1990, the now regulatory body of the NSE, Capital markets was constituted under the Capital Markets Authority Act (CAP 495A). In addition, the Bourse is the second Exchange in Africa after the Johannesburg Stock Exchange (JSE) to be self-listed. The Bourse had its first Initial Public Offering (IPO) in 1988, which proved to be successful.

The NSE has been at the forefront of introducing investment products within the Bourse. The NSE (2021) notes that it has been very innovative, and as a result, it was ranked the winner of the most innovative African Stock Exchange Award by the 2013 Africa Investor Index Series Awards. Subsequently, new products have been introduced by the Bourse to give it depth One Exchange Traded Fund was introduced in 2017 and in 2019, a green bond was introduced, while exchange traded derivatives and futures were also introduced. A new trading system provided by millennium technologies has been put in place.

The NSE is home to six indices: the NSE 20 Share Index, the NSE All Share Index, the FTSE NSE Kenya 15 Index, the FTSE NSE Kenya 25 Index, FTSE NSE Kenya Government Bond Index and the NSE 25 Share Index. Osoro and Jagongo (2013) point out that the first NSE index, the NSE 20 Share Index, has received criticism from stakeholders. As a result, the NSE All Share Index (NASI) was introduced in 2008 as a complementary index that constitutes all shares listed on the NSE. This suggests the representativeness of all listed companies on the NSE. In 2011, the NSE in collaboration with Financial Times Securities Exchange International, launched the FTSE Kenya Index series comprising three indices as named above. The NSE Chief executive, Mr. Odundo, launched the NSE 25 Share Index in 2015 (NSE, 2021; Business Daily, 2015).

The FTSE Kenya Index series, the NSE 20 Share Index and the NSE 25 Share Index are a set of indices that measure the performance of capital and industry segments in the NSE. These indices will be

examined as independent variable to find out their market representation ability for the introduction of index funds.

3.5 Regulations framework as a factor suitable for the introduction of index funds

Financial institutions are regulated because they are dealing with monetary investments and are required to act in an ethical, transparent manner. Investors cannot risk losing invested capital or returns. Scholars (Brown & Reilly 2009; Saunders & Cornett, 2009) explain that the responsibility of collective funds managers is to manage and invest retail and institutional investors savings. This calls for heavy regulations that are intended to protect investors against mal practices from fund managers. These heavy regulations are exhibited through regulatory and professional bodies that seek to protect investors and practitioners in the field. Consequently, in the endeavour of protecting investors' interest the CFA has promoted highest standards of ethics and professionalism within the investment community worldwide. This has been done through the development of a rigorous code of ethics and standards of professional conduct to be adhered to by security analyst and money managers (Brown & Reilly 2009). One may thus believe that the main purpose of regulations and legislation is to protect investors and encourage more to participate in financial markets. This gives rise to the markets being more competitive and efficient, while encouraging money managers to avail all relevant information to participants in the markets.

The Kenyan regulatory framework consists of primary and subsidiary legislation. According to Rothwell (2016), the primary legislation is set by the parliament and subsidiary legislation is delegated to executive branches. The Capital Markets Act promulgated by Government established the Capital Markets Authority (CMA) as the subsidiary regulatory body for this sector of the financial services industry. The body introduced secondary legislation in the form of regulations, rules and guidelines that it uses to govern and supervise the sector. It has proved to be the subsidiary regulatory body needed that creates rules and regulations for the sector. Rothwell (2016) adds that one of the set objectives of the CMA by government is the creation, maintenance and regulation of a market in which securities can be issued and traded in an orderly, fair, and efficient manner, through the implementation of a system in which the market participants are self-regulated to the maximum practicable extent. Finally, it is under the CMA that capital markets develop new products that deepen the markets to ensure orderliness and fairness in capital markets.

The Capital Markets Authority is therefore the Government-authorized body in Kenya that regulates capital markets. Its regulations, laws, rules, standards for ethical codes in financial markets are set to

protect the investor from unfair, unethical and unlawful practices from financial intermediaries and institutions. The investor is advised to observe all due diligence during investments and in the case of investing in capital markets then investor must ensure CMA authorisation of the investment instrument.

As discussed earlier, regulatory advancement has been achieved. It has been observed (PMC, 2017; Oxford Business Group, 2016) that during the period of 2013 to 2018, Kenya's financial sector became the 3rd largest in Sub-Saharan Africa with continued regulatory reforms within the sector being made. The Finance Act, Capital Markets Act and the New Companies Act have been passed. As a result of these continued regulatory reforms, this study assumes that there is an adequate regulatory framework in place in the Kenyan capital markets.

3.6 Conclusion

This chapter sought to review empirical studies for the purpose of reflecting on index funds and concepts related to index funds, a perusal of indexing, and passive and active fund management strategies was done as well. This led to discussions on factors that are required for the introduction of index funds. These factors are an informationally efficient capital market, market representative stock and a regulatory framework. The next chapter presents the theoretical framework of the study where the underlying theory of the study and related theoretical matters are presented.

CHAPTER 4

Theoretical framework for the investigation of the suitability of introduction of index funds

4.1 Introduction

The purpose of this chapter is to explain the theories that underlie this study. Informational efficiency in the capital market is mainly explained by the Efficient Market Hypothesis (EMH) advanced by Fama (1965). This is the central theory of the present study. Other theories that are relevant in this study and that are alluded to include the Modern Portfolio Theory (MPT), the Adaptive Market Hypothesis (AMH) and the Dow Theory.

Index funds require an efficient capital market for its introduction to the market, and therefore the EMH is the theory behind capital markets' efficiency. The EMH and Modern Portfolio Theory (MPT) assume that security markets are efficient, and that information is processed immediately (causing stock prices to adjust to new and correct levels). These prevent an investor from consistently earning excess returns by undertaking fundamental analyses or technical analyses.

The Modern Portfolio Theory (MPT) advanced by Harry Markowitz in 1952 explains the reduction of risk through portfolio diversification. The theory assumes efficiency of any given market for a successful portfolio to exist. Index funds consider the main rule in investments to be diversification. The Dow Theory seeks to explain the workings of technical analyses, hence its inclusion in this chapter. Technical and fundamental analyses are active management strategies that are utilised by active managers to beat the market. The Adaptive Market Hypothesis (AMH) seeks to bring consensus between mainstream economists and behavioural economists. The EMH has attracted criticism from technical analysts and fundamental analysts, and most criticism has arisen from the behavioural finance school. AMH was advanced as a solution to the criticism.

This chapter therefore presents a discussion of a number of theories: Section 4.2 explains the Efficient Market Hypothesis (EMH), Section 4.3 discusses the Dow theory, while Section 3.4 the Adaptive Market Hypothesis (AMH). Finally, Section 3.5 explains the Modern Portfolio Theory (MPT). The theories are linked with factors that determine the success of index funds.

4.2 The Efficient Market Hypothesis (EMH)

4.2.1 Development of the concept of Efficient Market Hypothesis (EMH)

The efficient market theory, also known as the Efficient Market Hypothesis or the Efficient Market Model, is one of the best-known theories in finance. The theory has changed somewhat since its emergence. Elton et al. (2014) explain that there is a vast body of literature on this theory, ranging over a period of 150 years. Regnault (1863) was one of the earliest scholars to formally express the EMH in his book. He was also the first empirical researcher to argue that market prices followed a random walk, and his research was based on British and French bond data. He expressed his observations and logical arguments on the behaviour of stock prices. Regnault held that the behaviour of stock prices at any time reflects the wisdom of the crowd; in other words, it reflects information available in the market and decisions of the market participants based on available information. Regnault thus equated fund managers to speculators or gamblers. It is therefore important to understand his notion of the “random walk”.

4.2.2 Random walk

Further development of the EMH was realised with the introduction of the random walk concept. Elton et al. (2014) explain that Louis Bachelier (1900) used Regnault’s random walk expression as foundation for his security price movement model. Elton et al., (2014:411) note that, “Bachelier developed the equations of Brownian motion – a continuous time expression of a random process – which relied on implicit assumptions of unpredictable price movements”. Option pricing models that are in use today are based on his Brownian models.

The random walk of prices simply means that security prices cannot be consistently repeated or known. Scholars (Elton et al., 2014:411; Gilli and Lee, 2008), inform us that Maurice Kendall (1953) took the idea and noted that stock and commodity prices follow a random walk. In 1953, Kendall presented a paper that examined security and commodity price movements over time, on the assumption that stock prices reflect recurrent ups and downs in economic performance. His arguments suggest that the empirical study was carried out with the assumption that stock prices and commodity prices would be predictable over time. His results were, however, contrary to this: he could not find any predictable pattern and prices seemed to evolve randomly (Elton et al., 2014:411; Gilli & Lee, 2008). Today’s price could not thus predict tomorrow’s price. He could establish no trend or recognisable pattern in price

changes. In other words, “there is no systematic correlation between one movement and subsequent ones”, according to Arnold (2013: 547). Consequently, price seems to follow a random walk.

Kendall’s argument was that the random walk was an irrational market behaviour, but later on conclusions were drawn that this was not a type of irrational behaviour, but rather an indication of a well-functioning or an efficient market. This argument justifies the notion that in an efficient market, prices change in a random manner. Bodie et al. (2010) further argue that the unpredictability of prices is far from constituting an irrational behaviour; rather, it is an indication of intelligent investors competing for relevant information that will enable them take advantage of the market. Concurring with Kendall’s stance, Mandelbrot (1963) and Samuelson (1965) performed more empirical work in this area. Mandelbrot (1963) derived the random walk hypothesis in a general framework, allowing for discontinuities and extreme events. In addition, Samuelson (1965) published the famous paper, “A proof that properly anticipated prices fluctuate randomly”.

The random walk, as the name suggests, means unforeseeable events or phenomena that cannot be anticipated or predicted. Bodie et al. (2010:229) define a random walk as “the notion that stock price changes are random and unpredictable”. A random walk is a result of price reflection of all available information in the market that has been unpredictably received. Kevin (2009) explains that the random walk theory holds that stock prices change due to changes in the economy, industry or company, information. These changes alter stock prices to new levels, either upwards or downwards, showing that information which is known is reflected in the price of the stock. The price will experience more changes when new information is received. This proves that individual price changes of a stock are indeed random, because information is unpredictable and how securities markets performance react to the information is also unpredictable. Kevin (2009:123) adds that, “changes in stock prices show independent behaviour and are dependent on the new pieces of information that are received but within themselves are independent of each other. Each price change is independent of each other because each change is caused by a new piece of information”. The author further explains that the premise of this theory is that changes in information are immediately and fully spread so that all investors have access to full information. Consequently, there are instant changes in the stock prices, and therefore stock prices reflect all available information on the stock market. Arnold (2013) explains why random walk occurs: it is predicated on a reflection of all available market information pertaining to stock prices at any given

time. In addition, any price change occurs upon arrival of new information. New information is independent of previous information, and it is unpredictable, and thus it could be good or bad. These issues result in unpredictable stock price changes.

4.2.2.1 The main hypothesis: The Efficient Market Hypothesis (EMH)

The Efficient Market Hypothesis has to do with the ability of securities' prices to reflect all available information in the capital market as well as the reaction of market participants to new information – also in terms of influences on changes in price, either upwards or downwards. Brown (2020) explains that Eugene Fama (1965) formalised the Efficient Market Hypothesis (EMH) using the law of iterated expectations. This hypothesis was further developed from the work of Fama (1965b) in his publication of “Random Walks in Stock Market Prices”.

Further developments were made, and these resulted in Fama's (1970) definition of the three levels of market efficiency. He also defined market efficiency as the full reflection of available information in security prices. Thus, the hypothesis attempts to explain the stock price behaviour which results in efficient capital markets, and how price behaviour affects return. Kevin (2009:124) explains that,

“the Efficient Market Hypothesis holds the view that in an efficient market, new information is processed and evaluated as it arrives and prices instantaneously adjust to new and correct levels. Consequently, an investor cannot consistently earn excess returns by undertaking fundamental analysis or technical analysis”.

This implies that new information arrives in the stock market in an unpredictable manner, and once investors learn of this information, they act upon it. These actions of investors cause security prices to adjust to the new information. Thus, security prices will increase or decrease according to the flow of information. In the long run, these unpredictable changes affect returns. This hypothesis infers that prices' movements are unpredictable, thus the understanding that it is not possible for an investor to beat the market consistently. Bodie et al. (2011) concur, noting that the EMH is the essence of the argument that prices follow a ‘random walk’ meaning price changes should be random and unpredictable. Bodie et al. (2010) add that, if prices were predictable, that would be an indication that not all relevant information is available regarding the market. As a result, the market is inefficient, and thus does not

follow random walk. These authors (2011) also note that a reflection of all available information in securities is evidence of an Efficient Market Hypothesis (EMH).

4.2.3 Levels of market efficiency

There are three levels of EMH: weak form market hypothesis, semi-strong form market hypothesis, and strong form market hypothesis. These three levels are explained by scholars (Reilly & Brown, 2003; Jordan, 2009; Bodie et al., 2010; Arnold, 2013) predicated on the work of Fama (1988). First, the weak form of market efficiency, asserts that stock prices reflect all information that is found in historical market trading data. This efficiency rules out technical and trend analyses. The weak form hypothesis asserts that this kind of information is public data, and thus so all market players have access to this information and investors take action as fast as they can.

Secondly, semi-strong market efficiency entails that stock prices already reflect all publicly available information that is beyond historical market trading data. This information includes, in addition to historic market data also fundamental firm data, quality of management, balance sheet composition, patents, earning forecast, and accounting practices. This form of efficiency rules out taking advantage of all publicly available information by active fund managers.

Lastly, strong form of market efficiency asserts that stock prices reflect all forms of information including private information that is available only to company insiders. This form of market efficiency includes both weak and semi-strong forms, and it is an extreme form of efficiency that has been described as. In a strong form, even insiders are unable to make abnormal returns. Titan (2014) observes that semi-strong and strong forms of EMH have been invalidated by the majority of studies and are therefore deemed unrealistic.

4.2.4 Tests of EMH

It is worthwhile to note that each level of market efficiency is tested differently in order to ascertain its efficiency. The present study sets out to test the weak form efficiency. According to Jones (2010), this level of efficiency is tested in two ways: through statistical tests of independence in changes of stock prices and, if independency is established, technical and fundamental analyses are of no value. Therefore, these are tests of the random behaviour of prices. These include tests such as the runs test and serial correlation tests (Reily & Brown 2009; Bodie et al., 2010). The second way is explained by Bodie et al

(2010) as tests of trading rules used by analysts who utilise past data. If the rules ascertain returns that are above a passive benchmark, then the market is not efficient. Tests of accomplishing trading rules were developed due to the argument by technical analysts that statistical tests of independence were too rigid. Their trading rules are too advanced to be tested by rigid statistical tests.

On the other hand, the semi-strong form of market efficiency is tested differently. According to Reilly and Brown (2009), the semi-strong form is tested through the analysis of information that is beyond historical market data. Either time-series returns or cross-sectional distribution of returns are utilised. The alternative way of testing semi strong efficiency is through event studies. This kind of study examines how fast stock prices adjust to specific significant economic events. Where stock prices are slow to adjust to new prices, analysts can realise returns beyond benchmarked passive returns (Reilly & Brown, 2009). This leads one to believe that in an efficient market, information would be immediately reflected in stock prices after an event. Bodie et al. (2009) explain that economic events include announcements of accounting changes, exchange listing, stock splits, initial public offerings (IPO), unexpected world events and economic news, and corporate events, among others. The majority of event studies show that the stock market reacted immediately as expected by the EMH, while a smaller number of few studies indicated that the stock market behaves otherwise (Bodie et al., 2009).

The third form of the EMH is an unrealistic form, as earlier discussed, and thus it poses a challenge during tests. However, Reilly and Brown (2009) explain that in order to test this hypothesis, no information should be privy to any group, and that all prices should adjust very quickly to new information. The authors purport that strong form EMH has been tested by analysis of returns of private investment groups like security analysts, stock exchange specialists. These groups are assumed to have access to private information and act quickly on public information before other investors. If these groups make above market returns, then the market is strong form efficient.

Statistical tests of weak form efficiency were used in the present study. These tests analysed the independency of changes in stock prices from one period to another.

4.2.5 Market anomalies

The EMH expects an efficient market to behave in a certain manner, and when the market does not behave in this manner, it deviates from EMH – resulting in market anomalies. Jones (2010) defines

market anomalies as techniques or strategies that contrast with expectations of an efficient market, and which involve exceptions in an efficient market. These anomalies include the size effect, the low P/E ratio, earnings announcements, calendar effects like the January effect, monthly effects, and days of the week effect.

It would be expected that large firms would outperform small firms in an efficient market, but the contrary is true. This is known as the firm size effect. Reilly and Brown (2009) note that studies conducted over a long period, between 20 to 35 years, showed that small firms consistently yielded larger risk-adjusted returns than large firms. In addition, after considering higher risk and realistic transactional costs and assuming annual rebalancing, small firms outperformed large size firms. Jones (2010) notes that Dreman argues that the better performance of small firms is based on stocks that trade thinly or not at all, have very small capitalisation, and are not easily bought by investors because of large spreads. Nonetheless, despite Dreman's argument, it is surprising that small cap firms would outperform large cap firms in an efficient market. Reilly and Brown (2009) emphasise that the firm size effect is a major efficient market anomaly.

Furthermore, there are firms that are neglected by investors. These tend to be small firms that can offer higher returns. Bodie et al. (2011) identify this scenario as the neglected firm effect, arguing that because these firms are less researched, information about them is rare and costly. They are, therefore, risky to invest in. The riskiness associated with these firms results in higher returns on these firms, and thus the higher returns can be termed as risk premium. However, it should be noted that this effect does not mean that it can be exploited, because high trading costs associated with small stock can easily nullify any higher returns that have been realised.

It should also be noted that the momentum effect and the reversal effect are other forms of market anomalies that are contrary to market efficiency. Bodie et al. (2009:239) describe the momentum effect as a, "tendency of well performing and poorly performing stocks in one period to continue that performance in the next period". This is contrary to efficient markets because of the unpredictability concept of price changes in EMH. Bodie et al. (2009:239) define the reversal effect as the, "tendency of poorly performing stocks and well performing stocks in one period to experience reversals in the following period".

Low P/E ratio is another market anomaly. Reilly and Brown (2011) explain that studies suggest that low P/E ratio stocks outperform high P/E ratio stocks. These authors argue that if this is true, then the existing relationship between historical ratios and performance of the market violates the EMH. Such a situation would imply that investors could predict the market by using publicly available information. As a result of this, there seems to be room for investors to exploit the market.

Jones (2010), however, cautions investors against utilising this strategy, and encourages diversification. It follows that this is not a very secure strategy, and returns would have to be protected through diversification. Bodie et al. (2009) note that an explanation of this phenomenon could be that the returns are not well adjusted to risk, and a wrong model could have been used for adjustments. This is because the higher the risk, the higher the price of the stock, and the lower the P/E ratio and the higher the returns. Another explanation to this is given by Reilly and Brown (2009) who argue that low P/E stock will overperform high P/E stock, because growth companies tend to be overvalued and so they tend to have a high P/E ratio. On the other hand, low growth companies are undervalued, hence their low P/E ratios.

The earnings announcement effect is a market anomaly that contradicts EMH. This anomaly indicates that after an earnings announcement, stock prices take time to adjust to the earnings. Jones (2010) notes that in an efficient market, stock prices would adjust immediately after an earnings announcement, but adjustments may lag. Reilly and Brown (2009) emphasise and say that stock prices do not adjust as quickly to surprises in earnings as expected by the semi-strong EMH. By implication, earnings surprises and earnings revisions can be utilised to yield higher returns. However, Jones (2010) cautions investors against use of standardised unexpected earnings (SUE) because the averages do not reflect what any investor would actually earn.

Calendar effects that contradict the EMH include the January effect, the monthly effect, the day of the week/weekend effect and an intraday effect. Reilly and Brown (2009) explain the calendar effect by indicating that studies on the monthly effect show that all markets' cumulative advance happened during the first half of the month. On the other hand, the authors explain that negative Monday effect stems from weekend effects. However, a positive Monday effect for a pure Monday effect is normally experienced in the month of January, but negative during other months of the year. Larger firms seem to experience

the weekend effect more acutely, while smaller firms seem to experience a pure Monday effect. In addition, Jones (2010) explains that small firms' returns tend to be higher in January than other months, thus creating the January effect. Despite some researchers declaring that the January effect has diminished, it seems to have continued over the years into the present (Jones, 2009).

Finally, the book value to market value ratios is another form of market anomaly. Bodie et al. (2011) explain that a study conducted by Fama and French (1992) showed that while firms with the highest book value to market ratio had higher returns, firms with low book to market ratios had lower returns. The ratio is independent of beta, and thus indicates that either the firms are under-priced and/or the ratio was serving as a proxy to risk that affected equilibrium. However, after adjustments, beta had no power to explain average security returns. This realisation challenged the EMH, because, "factors that should affect returns like systematic risk seem not to matter while factors that should not matter like the book to market ratio seem is capable of predicting returns" (Bodie et al., 2011:363).

In conclusion, the size of the firm effect, the neglected firm effect, the momentum and reversal effect, the low P/E ratio effect, earnings announcement effects, and calendar effects are contrary to the EMH. These anomalies can lead one to believe that there are chances for analysts to earn higher returns through careful considerations of these effects. However, Bodie et al. (2011) point out that there is an apparent inability by active managers to beat the market by taking advantage of this anomalies. This may cause one to doubt whether these anomalies can actually yield excess returns. Bodie et al. (2011) therefore caution investors to implement these strategies with care and to consider the risk levels of a firms. Diversification should also be prioritised, and the standardised unexpected earnings (SUE) ratio must be handled with caution. Despite these cautions, there seems to be a possibility to beat the market while utilising some of these strategies.

4.2.6 Assumptions of the EMH

The EMH is based on some assumptions. Reilly and Brown (1994) outline these assumptions as, new information regarding securities coming to the market in a random manner. Large number of competing profits maximise participants in the capital markets to analyse and value securities. Each of these exist independently of the other to rationally attempt to adjust security prices rapidly to reflect the effect of new information.

4.2.7 Implications of EMH

The EMH has obvious implications on strategies of investment. The intended implication is explained by Brown (2020:5) as, “prior to Eugene Fama’s 1965 contribution to the *Financial Analysts Journal*, making money on Wall Street was considered to be easy. The practical implication of the Efficient Market Hypothesis (EMH) changed that presumption”. Prior to 1965, technical analysts purported that it was easy to make money. The initial intended practical implication of the hypothesis was to establish professionalism among investment managers and to show that they can add value (Brown, 2020).

Despite this initial intent of the EMH, other implications stemmed out of the hypothesis. Scholars (Reilly & Brown, 2003:253; Kevin, 2009:124; Jordan, 2009:211) point out that one of these implications is the futility of technical analysis. They advise that prices in an efficient capital market change randomly and immediately when new information is released. It is therefore futile to apply technical analyses or fundamental analyses to earn superior returns. Technical analysts, on the other hand, believe that stock prices move in trends that persist, and that market prices react gradually to the new information. Technicians get hold of new information first, followed by aggressive investors and then general investors.

The gradual change in stock prices presents an opportunity for above market price returns. This view is contrary to the notion of efficient markets that implies that stock price changes cannot be predicted, because price changes occur rapidly and randomly according to the arrival of new information. This infers that there is no need for technical analysis in the management of an investment portfolio. In addition, Bodie et al. (2010) point out that proponents of EMH dismiss active fund management as wasted effort and unlikely to justify the hefty costs associated with managing the funds. As a result, they advocate for a passive investment strategy that does not attempt to beat the market: hence indexing.

The Efficient Market Hypothesis has implications for fundamental analysis. This kind of analysis does not only consider historical market information; it also considers economic information including industry performance, interest rates, and economic indicators. These are referred to as components of fundamental analysis.

Reilly and Brown (2003) confirm that some of the components of fundamental analysis include industry and company analysis, aggregate market analysis and portfolio management. Thus, a fundamental analyst integrates these components to estimate the intrinsic stock values. This also leads one to believe that if a market is weak form inefficient, only then can fundamental analysis be used by active managers. This is because the securities prices already reflect all past historical information. According to Reilly and Brown (2003), understanding relevant variables that affect return is important when carrying out fundamental company and industry analysis. Aggregate market analysis, which is one of the components, is based on evaluating historical information. Reilly and Brown (2003) purport that one of the EMH implications is that using aggregate analysis to estimate future values will not result to superior fundamental analysis. Thus, this futility is experienced in company analysis and industry analysis as well as in historical information analysis. This is the case, because historical information is in the public domain. Bodie et al. (2009) propound that the argument of EMH proponents is that if the analysts are using publicly available information, it will lead to similar conclusions from other analysts. And, as a result, it will yield similar outcomes.

In light of the above discussions a buy-and-hold (a passive management strategy) is suggested for the management of investment portfolios. Jordan (2009) conclude that buy and hold strategies involving broad market indices are extremely difficult to outperform. Therefore, market efficiency advocates for passive investment strategies that include indexing. Reilly and Brown (2009) suggest that, “the EMH implies that if you examine only past events, it is unlikely that you will outperform a buy-and-hold policy because the market rapidly adjusts to known economic events”. Jones (2010) adds that a buy and hold strategy simply entails that an investor buys stock and holds it until an objective is met, then sells it.

On the other hand, it is suggested that superior analysts can achieve superior returns by applying fundamental analysis. Reilly and Brown (2009) note that superior job must be done in order to achieve higher returns in an efficient market. Not only for purposes of doing a superior job, but to achieve consistency in achieving superior returns. A superior analyst must be able to project earnings accurately and have expectations that are different from the majority. This infers that a superior manager must dispose of techniques and skills that can facilitate a competitive advantage over other market analysts, enabling him or her to consistently outperform. Although according to Reilly and Brown (2009), it is extremely difficult to find a superior analyst, and the authors advise that superior market analysts should

consider more market anomaly techniques such as the P/E ratio consideration, the size of the firm, whether it is a neglected firm, and the book value market value (BV/MV) ratio in an efficient market.

Through arbitrage activities performed by rational superior analysts, anomalies can be exploited for further profits, as noted above. However, there are many factors to consider, and an arbitrageur may not fully take advantage of mispricing caused by market anomalies because of the factors. Firstly, an analyst must consider the fundamental risk of an opportunity before taking advantage of the opportunity. Bodie et al. (2011) warn of risks like the fundamental risk to an investor when pursuing an opportunity. A trader might take into consideration that an under-pricing might get worse, and the trader might end up losing his or her reputation as an analyst and even losing capital. These factors might cause an analyst not to pursue such opportunities.

Another factor to consider is model risk. Bodie et al. (2011) explain that a model that has been used for pricing a security might be erroneous. If this is the case, it might be risky to pursue an investment opportunity.

In order to take advantage of a profit opportunity, there are costs that will be incurred, notably transactional costs. Time implications in the case of short selling must also be considered. Bodie et al. (2011) point out that an analyst must consider the implementation costs of a short sell for instance. Also, the time horizon for executing a short sell might be too limited, especially for mutual funds and pensions that have strict limits on their discretion.

The law of one price can hinder arbitrage activities. Ideally, similar commodities should have similar prices, and likewise, similar securities should have one price. According to Bodie et al. (2011), if two similar securities are priced differently, one is overpriced and the other is under-priced. Then, a common-sense strategy would be to buy the under-priced security and short sell the overpriced security. However, if these prices persist and they do not converge to their intrinsic value, there is a problem, and an investor could incur a great loss. Caution amongst analysts is key. Bodie et al. (2011) give example of the “Siamese Twin” companies (the Royal Dutch and Shell companies) where a similar scenario was experienced and the prices did not go back to their intrinsic value for a very long time. This was also the case with the 3coma and Palm companies in 1999.

In summary, these implications lead one to believe that in an efficient market, fund managers who have superior capabilities can be engaged to realise superior returns. However, investors should take heed when identifying superior fund managers. One of the ways to identify them is through their ability to continuously beat the market. Scholars (Reilly & Brown, 2009; Bodie et al., 2011) advice investors to follow the recommendation of a portfolio manager who can consistently deliver higher returns than benchmarked returns.

Moreover, investors who cannot identify superior active managers in an efficient market can manage their own portfolios. These investors, according to Reilly and Brown (2009), can determine their own level of risk and build their own risk portfolios by balancing between having a risk free and risky asset portfolio. They can also diversify completely on a global basis to eliminate all unsystematic risk. Twenty securities can achieve this, maintain very low transactional costs through; minimising taxes, trading only to maintain a given risk level, and trading only in very liquid stocks to minimise liquidity costs. In other words, according to Reilly and Brown (2009:177), “run your portfolio as an index fund or an ETF”.

In conclusion, without a superior manager, an ordinary investor is advised to run his or her portfolio as an index fund or an ETF. According to the discussion above, index funds are more cost effective than ETFs, and thus the higher return implications of an index fund. It follows that index funds are advantageous in a financial market. This leads one back to the question as to whether it is suitable to introduce index funds to the Kenyan financial markets so that investors can take advantage of these.

4.2.8 Criticism of the Efficient Market Hypothesis

The EMH has received criticism from academics, especially behavioural finance proponents and professional portfolio managers, and also for the most part from active fund managers. Lo (2007), notes that despite theoretical and empirical evidence for and against the EMH, there is still no consensus amongst economists.

The EMH is refutable according to critics. One of the reasons that the hypothesis has not been widely accepted is, “the fact that the EMH, by itself, is not a well-defined and is an empirically refutable hypothesis” (Lo, 2007:12). This is presuming that modifications must be done for the theory to be operational: “Test of EMH is a test of several auxiliary hypotheses as well, and a rejection of such a joint

hypothesis tells us little about which aspect of the joint hypothesis is inconsistent with the data. For instance, are stocks volatile because of market inefficiencies or because of dividend smoothing or aversion?” (Lo, 2007:12).

The second criticism is that the EMH does not consider other factors that influence efficiency apart from statistical tests. Lo (2007), further criticises the EMH by stating that it is not an effective means of rating the efficiency of a given market, and advises what is of consequence is the efficiency of a particular market relative to other markets, for instance, the bond market versus the stock market, or the futures market versus the spot market. This is known as relative efficiency. It is assumed that the hypothesis does not aggregate all the elements that constitute efficiency in a given market. It is not ideal, according to Lo (2007), to consider a market fully efficient only through performing statistical tests. That ideal can work only in an idealised frictionless world of the imagination. Relative efficiency is, however, more ideal. From a practical point of view, the EMH is economically unachievable, but it serves as a useful benchmark for measuring relative efficiency (Grossman & Stiglitz, 1980).

The EMH is also not widely accepted in the community of professional portfolio managers. As it implies, their efforts may be futile and costly to their clients. Debate therefore continues as to the degree to which security analysis can improve investment performance. Brown (2020), however, propounds that this hypothesis only holds that price changes are unpredictable and does not constitute an attack on professional fund managers. Scholars (Bodie et al., 2010) in defence of active portfolio management point out that activities of investment managers are the force behind fair market prices that make up efficient prices. The second argument in defence of professional fund management is that investors who find investment schemes that generate abnormal returns would not be willing to report the results to the entire world, and lastly, superior records of investment managers who are lucky to achieve fantastic investment performance over the recent past disprove the efficient hypothesis. This last argument has been disproved by proponents of the theory who argue that the proper test for this is to see whether successful investors can repeat their performance.

Academics have further criticised the hypothesis for its purported inability to consider all forms of information. According to Brown (2020), this information includes earnings, dividends, indices of business confidence and prices of other stock, as well as expectations and market volatility – therefore

invalidating the theory. Brown (2020) adds that criticism has been offered that the hypothesis does not consider the bid-ask spread, and thus information is slow in reaching all market participants.

Human behaviour is both rational and irrational. Lo (2007) notes that the most severe criticism of the hypothesis emanates from behavioural finance proponents who argue that the EMH disregards the fact that human behaviour is not always rational. The EMH models are predicated on rational behaviour, and they do not consider investor's irrational behaviour such as herding, overreaction or under-reaction, hyperbolic discounting, psychological accounting, or loss aversion. These behaviours may push prices beyond their fair and rational market value. It may be inferred from this argument that human behaviour deeply influences and affects financial decisions. In addition, Brown (2020) points out that since 2000, there has been many publications documenting divergence from the rational in financial markets, and this has been attributed to behavioural factors.

In conclusion, despite these criticisms, the EMH plays and continues to play a key role in finance. Wojcik et al. (2012) note that the EMH is still used as a benchmark and that the behavioural school of finance is far from stealing a match from the EMH. In response to this criticism, it has been observed that the increase of access to information, data and high-speed computing are likely to encourage more rational behaviour, as prices are accurately reflected in available information. It can then be presumed that advancements in technology can aid market efficiency. O'Hara (2014) observes the technological trade with high frequency trading, which is basically computer programs being used for trading purposes. This author advises portfolio managers to change from traditional ways of trading towards using technology in an intelligent way. Understanding the implications of data and utilising available information to create alternative appropriate portfolio can meet clients' objectives, and thus provide investment counselling to investors. In light of this, the EMH is very relevant in the financial markets and has influence over the markets. It is therefore also relevant for the present study.

4.3 Dow Theory

In contrast with the EMH, the Dow Theory suggests the predictability of the stock market through the technical analysis of changes in the stock prices. This theory is discussed in the present chapter, because reference is made to active management strategies which include technical analysis and fundamental analysis. Technical analysts analyse the underlying trend within the market and its corrections.

According to scholars (Bodie et al., 2011; Jones, 2010), the Dow Theory was initially initiated by Charles H. Dow, the father of technical analysis and founder of the *Wall Street Journal* in the 1800s. The theory proposes that there are three trends that affect price movements. These trends are the primary trend (which is the long-term market movement that lasts for years); and the second trend, which is the secondary or intermediate trend that lasts for weeks or months. The secondary movements are caused by short-term deviations of prices from the underlying primary trend. These deviations are regarded as the market correcting itself, prices go back to the market values. The last type of trend is the day-to-day movements of the market. These movements occur daily and randomly. The daily movements are deviations from the secondary and primary trends, and are not useful to technical analysts, since these daily changes do not affect prices over the long run. It follows that the observation of the primary and secondary trends enables price forecasting.

In addition, Jones (2010) demonstrates that the Dow Theory is a technique for detecting long-term trends in the aggregate stock market, and its intention is to forecast the start of a primary movement – although it does not tell us how long the trend will last. Technical analysts focus is on the primary trend of the market, the secondary trends and the price corrections that result from these movements with the help aid of statistical methods. They can, as a result, take advantage of changes to beat the market. As a consequence of these activities, of primary, secondary and price corrections, hefty management prices arise. Jones (2010) further explains that an upward move occurs when current highs that follow each other are higher than previous highs, and the lows are above previous lows, bringing about a bull market. The downward trend, on the other hand, happens when a current downward trend is lower than previous lows, while the highs do not surpass previous highs – thus creating a bear market. Further confirmation of the downward and upward trend happens when the Dow Jones Industrial Average (DJIA) and the Transport Average confirm each other. Confirmations are, however, difficult to establish.

The Dow Theory, like many other theories, has been modified over the years by scholars. There are various variations of the theory. Bodie et al. (2011) mention the Elliot and the Kondratieff waves as variations of the theory. The Kondratieff Theory demonstrates that, “the macro economy moves (and therefore the stock market) moves in broad waves lasting between 48 to 60 years”. Unlike the Dow

Theory's primary waves, the Kondratieff waves are longer. The predictive power of the theory is, however, difficult to test empirically. The Elliot and Kondratieff theories consider a similar underlying trend: the primary trend. Bodie et al. (2011:394) justify this and note that, "stock prices can be described by a set of wave pattern. Long-term and short-term wave cycles are superimposed and results in a complicated pattern of price movements, but by interpreting the cycle, one can, according to the theory, predict broad movements".

The Dow Theory has been found wanting, however, since beating the market consistently has been a challenge to the majority of technical analysts according to empirical studies. This has been a source of never-ending debate. The Dow Theory has, in light of this, received criticism over the years. As discussed earlier, empirical evidence has leaned towards passive funds outperforming active funds, thus proving technical analysis to be futile. Jones (2010) notes that over periods of 25 years, investors would make more returns by means of a buy and hold portfolio management strategy. The second criticism is that there are different variations of the Dow Theory, and these differences can cause a problem. Jones (2010) indicates that the different variations result in different interpretations, and therefore predictions of trends end up being conflicting. Lastly, confirming movements is extremely difficult: "The amount of price movements needed for confirmation is ambiguous" (Jones, 2010:404).

4.3.1 Technical analysis

The Dow Theory is the underlying guide of the technical analysis practices of active managers, and consequently, it is important to understand technical analysis at this point. Technical analysis is an active portfolio management strategy that seeks to predict future stock prices for purposes of exploitation of the market. Jones (2010) confirms that technical analysis entails the use of specific market generated data for the analysis of both aggregate stock prices and individual stocks. It is sometimes referred to as market or internal analysis. This is because unlike fundamental analysis that focuses on economic and political factors that are external to the market itself, technical analysis focuses on internal factors by analysing aggregate market, industry average or stock movements. These movements create trends that can be exploited.

Jones (2010) propounds that as stock prices change to new equilibria or correct themselves, there is an indication of direction or trend. This direction and trend can be utilised for forecast purposes.

Bodie et al., (2010) note that technical analysts are known as chartists, because they study records or past stock prices to find patterns that they can explore to make a profit; patterns that indicate trading signals. In addition, Jones (2010) states that the analysts seek for movements by assessing price movements through technical indicators and charts. Examples of technical indicators are breadth of market data, market sentiment, and momentum indicators. These changes are presented through trends, troughs, trading volumes, booms and market prices to predict future stock price movement. Bodie et al. (2010: 233) explain technical analysis as, “research on recurrent and predictable stock price patterns and on proxies for buy or sell pressure in the market”. This suggests that for technical analysis to succeed, there has to be continuous research in order to find exploitable patterns. Bodie et al. (2010) add that technical analysts believe that if the stock price responded slowly to new information, they are able to identify a trend that enables superior returns within that period, and to that end, they take advantage of a slow response to new information.

Technical analysts use the notion of resistance level. This is the price level above which the stock is not expected to rise. They also use the notion of support level, which is the level below which the stock is not expected to fall. According to Jones (2010), these price levels indicate whether a market is behaving in a bearish or in a bullish manner.

It is worthwhile to note that volume and price are important aspects in technical analysis. According to Jones (2010), demand and supply drive the prices of securities, and volume data shows how the market is. The author advises that falling volumes should coincide with a falling price, and rising volumes should coincide with rising prices. Any contrary indication, for instance falling volumes and rising prices, should be treated in a sceptical manner, and it should not be considered as a true indicator of an upward trend.

Criticism from the EMH proponents point out the futility of technical analysis. According to Bodie et al. (2010), technical strategies are dismissed by the EMH proponents, as these are applied in an effort to beat the market and suggest that any information that is out there has already been absorbed into the stock price. If not, investors would have realised and exploited this information to bring the stock price to levels where expected rates of return are in alignment with the level of risk. It follows that one cannot repeat or expect abnormal returns sustainably. In an efficient market, it is advised that whenever a chartist can realise a profitable trading rule, other chartists will realise this because information is publicly

available, and they will overuse the rule – thus driving prices to correct levels. As a result, the rule is longer profitable (Bodie et al. 2010).

4.3.2 Technical analysis and behavioural finance

Technical analysis is connected to behavioural finance. Jones (2010) explains that, “technicians believe that prices move in trends that are determined by changes in investor attitudes toward various factors”. It follows that movements in the market are directed by irrational or rational behaviours. In addition, Jones (2010) holds that chartists believe that emotions influence stock prices. These two reasons make it is fair to connect behavioural finance and technical analysis. It also proves that movements in the stock market are results of human behaviour, which may be rational or irrational. Also, it points to the underlying psychology of investors, thus the connection between technical analysts and behavioural finance. Irrational behaviours can cause movements that deviate from market efficiency, resulting in a non-efficient non-random movement. Moreover, Bodie et al. (2011) note that market fundamentals can be disturbed by investors’ irrational behaviour that, in turn, create the opportunity to exploit the market. Furthermore, the authors add that volume data that is applied during technical analysis is heavily influenced by the behavioural biases of investors. Some of the behavioural tendencies that influence market movements are overconfidence and the disposition effect.

4.3.3 Fundamental analysis

Similar to technical analysis, fundamental analysis is an active management strategy that is used by active managers in an attempt to predict future prices. Fundamental analysts seek to determine whether stock prices are below or above their intrinsic value, and whether the prices are moving towards the intrinsic value. Jones (2010) explains fundamental analysis as the use of a company’s financial variables to determine the intrinsic value of the company. These variables include the tax rate, source of financing, profit margins, firm’s competitive position, labour relations, technological changes, foreign competition. Bodie et al. (2010:234), on the other hand, define fundamental analysis as, “research on determinants of stock value, such as earnings and dividend prospects, expectations for future interest rates and risk of the firm, so as to determine the proper stock price”. Thus, unlike technical analysis that utilises market data that is published, fundamental analysts conduct research on the quality of the firm, industry analysis, the stand of the firm in the industry and factor analysis. These analysts do this in the hope of determining intrinsic stock value that has not yet been recognised in order to reap abnormal returns in the future (Bodie et al., 2010). Consequently, an investor should invest in a stock when the price is below its

intrinsic value and sell stock when it is above its intrinsic price. Reilly and Brown (2003) purport that this is due to the fact that fundamental analysts believe that intrinsic value and market may differ at times. Investors eventually come to realize this and correct the discrepancy. Fundamental analysis should result in a better understanding of the company variables, and an assessment of the estimated value and to determine the value and potential of the company. Jones (2010) suggests that an investor can use the dividend discount model to value the stock or the earnings multiplier model to value based on, $P_0 = \text{Current stock price} - E_0 (P_0/E_0)$ where, E_0 = the most recent 12-month earnings per share (EPS).

The EMH refutes fundamental analysis. Bodie et al. (2009) note that the argument of EMH proponents is that if analysts are using publicly available information, this will lead to similar conclusions from other analysts. As a result, it will be futile to utilise such analysis in an efficient market. Reilly and Brown (2003), however, make an exception to this point and conclude that only superior analysts with unique insight and skill will be rewarded by the fundamental analysis approach. A discussion on superior managers who can deliver returns that beat the benchmark is given in the following sub-section.

4.3.4 Superior active managers (SAMs)

Despite reports on the inability of active managers to beat the market, some believe that superior active managers (SAMs) can outperform the market. Jones and Wermer (2011) found that inferior active managers (IAM's) cannot outperform an index benchmark fund; however, superior active managers (SAMs) can outperform benchmark index. The authors add that it is challenging to identify superior active managers (SAM's). However, methods of identifying SAMs are identified as past performance of active manager's analysis, macroeconomic forecasting, analysis of the characters of fund managers, and fund holdings analysis. This implies that one needs to be knowledgeable in analysing of market performance in order to choose an SAM. Additionally, Reilly and Brown (2009) emphasise that superior investors can do a superior job, consistently time the market, and earn returns that beat the market. However, finding this kind of investors is not easy.

The continued outperformance of fund managers is one of the ways to identify SAMs. According to Jones and Wermer (2011), past performance of superior active managers is one way of identifying them. Continued outperformance of a fund manager can be identified through adjusting returns for style and sector biases and non-normality of returns adjustment:

“Investors can likely identify SAMs by analysing past performance, but they should be careful to account for non-normal return distributions (such as those with skewness or fat tails) and various style/sector biases by using a sophisticated performance attribution system. Using less sophisticated techniques greatly diminishes one's ability to find true SAMs on the basis of past performance. Expertise must be applied in order to identify SAM's” (Jones & Wermer, 2011:36).

It follows that this method may be disadvantageous to those investors who cannot access these sophisticated techniques, especially retail investors, for whom this method may not work.

The second way in which SAM's can be identified is through the correlation of performance and the macroeconomic environment. Jones and Wermer (2011) point out that macroeconomic factors like interest rates, credit defaulters, recession, periods of high volatility and uncertainty can be used to predict performance through correlation of these factors and performance of the active funds. A particular active fund may perform better under certain macroeconomic conditions, while underperforming under other macroeconomic conditions. Using macroeconomic forecasting techniques, an investor may choose to invest in different funds, depending on their performance under particular macroeconomic conditions. The implication of this is that an investor must grasp sophisticated methods for correlation analysis that a retail investor might not access. Jones and Wermer (2011) say as much: this method at times may yield contrary results to performance analysis, but it offers partial hedging for investors because an investor can invest in different funds that perform well in different macroeconomic seasons – hence reducing risk.

Characteristics of active fund managers can also be used to identify SAM's. According to Jones and Wermer (2011), a variety of characteristics can be used. For instance, fund managers who are well educated and followed sound MBA programmes outperform benchmark fund. Managers who are well connected with industry peers tend to have access to information and tend to outperform, while fund managers with lower fund management fees tend to outperform. Fund managers with experience who work in larger and older funds also tend to outperform inexperienced managers who work in newer and smaller funds. Managers with higher incentive fees outperform managers who have invested in their own firms, managers with low cash balances outperform those with higher cash balances, managers with a variety of styles exposure outperform, and managers with flatter organisational structures and those who choose to focus on a particular industry or sector outperform.

The stability of holding assets is a good indicator of a SAM. Jones and Wermer (2011) further explain that assets held by fund managers can be used to determine SAM's. The authors explain that in their findings, fund managers with asset holding risks that remain consistent over a long period of time tend to outperform managers whose asset holding risks are not steady. Managers might take on too many risky assets with the intent to keep up with competition, or they might lower the risk with the intent of maintaining their performance. It has, however, been proven that managers who manage risks and consistently hold a certain level of risk (whether high or low) tend to outperform benchmark indices. In addition, managers who have large negative return gaps tend to underperform, because the gaps are an indication of the mismanagement of funds. Managers who tend to move contrary to other managers (that is, those who avoid herding behaviour with regard to asset holdings) tend to be SAM. This strategy can only be applicable where fund managers publicly disclose assets that they hold. If there is no such disclosure, it is impossible for an ordinary investor to use this strategy.

In conclusion, the Dow Theory seeks to explain technical analysis. This theory was discussed because EMH critics are active fund managers who utilise technical and fundamental analysts. Technical analysts believe that it is possible to exploit opportunities in the market for higher returns. These opportunities are created by investors' irrational behaviours and emotional tendencies, as explained by behavioural finance. Technical analysts, in their efforts to exploit the market, focus on internal factors such as analysing aggregate market, industry average or stock movements. Fundamental analysts, on the other hand, focus on economic and political factors that are external to the market itself. Inasmuch as active managers (both technical and fundamental analysts) have been criticised of underperformance, there are suggestions of SAMs outperforming the market. The challenge is identifying these SAMs. The next subsection explains the Adaptive Market Hypothesis (AMH).

4.4 Adaptive Markets Hypothesis (AMH)

Criticism of the EMH has led to the AMH. The EMH has been a source of controversy, and has led to criticism of its assumptions – especially from behavioural finance. To realise consensus between the two proponents, the AMH was developed and is still under development. The adaptive markets hypothesis (AMH) is meant to reconcile the mainstream and the behavioural economists. In other words, the AMH merges the EMH and behavioural finance. It is viewed as a new version of EMH which takes into consideration psychological biases that encompass irrational behaviour. The AMH is thus another way of interpreting the EMH.

Behavioural economists influenced the AMH. Lo (2007) explains that the AMH has been heavily influenced by the 'evolutionary psychology' that builds on the seminal research of E.O. Wilson (1975). Wilson advanced the idea of applying natural selection, competition and reproduction to social interactions. He explained human behaviour such as fairness, kin selection, religion, morality using the principles suggested. Wilson (1975) also suggested that this same principle can be applied to economic and financial contexts.

This theory is hinged on adaptation in a market. According to Lo (2007), the theory of AMH suggests that in a large market where resources and stock prices are available, there are many market participants competing for those stocks. The market becomes efficient as market participants competing for those stocks adapt to the market conditions, and bring security prices to their intrinsic value. This implies that the AMH is a version of the EMH that is derived from evolutionary principles: "Prices reflect as much information as dictated by the combination of environmental conditions and the number and nature of 'species' in the economy or to use the appropriate term, the ecology" (Lo, 2007:18). Thus, species in this case indicate market participants (for instant retail investors, fund managers, technical and fundamental analysts). Lo (2007) states that in the case where participants in an ecology compete for scarce resources, the market becomes highly efficient. However, if there are fewer competitors and the market is full of resources, then the market is less efficient. It follows that, whether one looks at efficiency or inefficiency, market participants will have to adopt to new management strategies, thus the word 'adaptive' market hypothesis. This theory clearly indicates that change on the part of market participants and efficiency is inevitable.

A local ecology evolves based on the bare necessities such as food and water in that particular environment. If one were to look at economic profits as the ultimate source of food on which participants depend, the dynamics of the market is shaped by competition for this ultimate source of food (Lo, 2007). This proves that market efficiency will adapt based on competition. When the market is efficient because the resources are few and competition is high, investment strategies will change, and when resources are plenty and there are market inefficiencies, the investment strategies will change to accommodate the inefficiencies. Thus, under an AMH investment, strategies proceed through a cycle.

According to this theory, market efficiency must be evaluated in light of many factors. Lo (2007) explains that market efficiency cannot be evaluated as an independent entity; rather, it must be evaluated in context that is the context and dynamics of its environment. This is equated to an animal population's increase or decrease: it cannot be evaluated on its own, but must be evaluated on the basis of predators, food, and their adaptability to the environment. Likewise, the efficiency of a given market must be evaluated in relation to its environment.

Behavioural biases abound under EMH. Lo and Repin (2002) present evidence that for “highly experienced professional securities traders, the physiological variables associated with the automatic nervous system are highly correlated with market events”. This implies that emotions play a major role in financial decisions. Indeed, fear and greed are the major causes of irrational thinking in finance decisions (Lo, 2007). The author argues that emotion plays a day-to-day role in finance risk processing, and an important concept on the part of financial market participant is the ability to channel emotion in the right direction. The AMH theory takes behavioural finance into consideration and combines it with the EMH components to reconcile the two.

The Efficient Market Hypothesis (EMH) focusses on market efficiency characterised by stock prices that reflect all available market information as well as the purported rational behaviour of market participants. Behavioural finance, on the other hand, focuses on the irrational behaviour of market participants and holds that the market is characterised by market inefficiency and decision-heuristics processes. The Adaptive Market Hypothesis (AMH) seeks to reconcile the EMH and behavioural finance. AMH is a combination of finance theory, cognitive psychology and evolutionary principles. The hypothesis suggests cyclical market efficiencies and inefficiencies that depend on the environment, market participants, market size and economic conditions. The AMH proposes a strong measure of adaptability to the environment and recognises the role of human emotions in financial decisions. In other words, the AMH is a new version of the EMH.

4.5 Modern Portfolio Theory (MPT)

The Modern Portfolio Theory (MPT) seeks to explain expected returns, risk levels and diversification. This theory was introduced by Harry Markowitz in 1952 and earned him a Nobel Prize for economics in 1990 (Pratt, 2018). The theory holds that it is possible to construct an ‘efficient frontier’ of optimal portfolios, offering the maximum possible expected returns for a given level of risk. At the same time,

one may be giving the lowest level of risk for each level of expected return. By investing in more than one stock, an investor can reap the benefits of diversification, particularly a reduction in the riskiness of the portfolio. It is also necessary to avoid investing in securities with high covariance amongst themselves (Pratt, 2018).

The MPT explains the relationship between the maximum expected return and risk. Prat (2018) states that investors would prefer to gain more wealth while minimising the risk. Harry Markowitz, however, rejects the idea that a portfolio presents both the maximum expected return and the minimum risk. He explains that a portfolio that gives maximum expected returns is not necessarily one with minimum risk. An investor can gain expected returns by taking on a risk or reduce a risk by giving up return. Reilly and Brown, (2003) note that Markowitz derived the expected rate of return for a given portfolio, the expected risk measure, and he demonstrated that the variance of the rate of return was measure of portfolio risk. Markowitz thus developed a formula for computing the variance of a portfolio that showed the importance of diversifying, and how to diversify.

The MPT explains market risk, industry risk and firm risk in relation to diversification. Pratt (2018) further adds that the theory identifies three components of risk in owning a security. These components are market risk, industry risk and firm risk. Market risk cannot be diversified by the application of this theory due to its commonality to all securities available in the securities market. Industry risk and firm risk can, however, be reduced through diversification: “Modern portfolio theory (MPT) directs attention away from traditional focus on the selection of individual securities towards the composition of the portfolio as a whole” (Pratt, 2018:25).

4.5.1 Assumptions of the theory

The Modern Portfolio Theory has assumptions mainly pertaining to risk and expected return, utility, variability, rationality, liquidity and informational efficiency. Reilly and Brown (2003:183) list these assumptions as;

“each investment alternative is represented by a probability distribution of expected returns over some holding period, investors maximize one period expected utility, and their utility curves demonstrate diminishing marginal utility of wealth, investors estimate the risk of the portfolio on the basis of the variability of expected returns, investors base decisions solely on expected returns

and risk, so their utility curves are a function of expected returns and the expected variance (or standard deviation) of returns only, for a given risk level, investors prefer higher returns to lower returns. Similarly, for a given level of expected return, investors prefer less risk to more risk”.

The assumptions prove that wealth creation according to the theory has to do with how much level of risk an investor is willing to bear in relation to expected returns. Pratt (2018) explains that the MPT is based on the assumptions that investors make rational decisions and that securities markets are efficient, that is, they can reflect information that is available about the securities being traded. Wagner (2017:5) concurs with Pratt by recognising that, “the MPT assumes liquid markets and does not allow for illiquidity and informational problems”.

4.5.2 Criticism of the theory

Criticism of the MPT has been mainly focused on the assumptions of the theory. Pratt (2018) believes that critics accept the basic idea of the theory, namely that diversification reduces risks. He argues that the assumptions about investors and markets compromise the theory. The basic assumption of investors being rational has been criticised by proponents of behavioural finance who emphasise that emotions are the most important determinants of long-term wealth. It is also implied that market prices are driven by emotional investors other than fundamental investors, and markets are not informationally efficient.

4.6 Relevance of the multi theories to the current study

4.6.1 The EMH and Random walk

The Efficient Market Hypothesis (EMH) is the main theory of this study. This research is based on this theory because index funds as discussed require an efficient market where prices change immediately new information is received in the market. The hypothesis explains price changes and according to Kevin (2009:124),

“the Efficient Market Hypothesis holds the view that in an efficient market, new information is processed and evaluated as it arrives and prices instantaneously adjust to new and correct levels. Consequently, an investor cannot consistently earn excess returns by undertaking fundamental analysis or technical analysis”.

The information arrives in the market in unpredictable manner and changes in price returns are consequently unpredictable. This unpredictability is referred to as a random walk. The prices follow a ‘random walk’ meaning price changes are random and unpredictable. The EMH is a development of the

random walk theory that was first mentioned by Regnault (1863) who was one of the earliest scholars to formally express the EMH in his book. He explained through his findings that stock prices behave in a random unpredictable manner hence fund managers cannot predict the behaviour of the prices in order to make extraordinary gains.

Based on the Efficient Market Hypothesis (EMH) that was developed from the notion of the random walk, this research took place. This research analysed the NSE indices to find whether the changes in the stock prices follow the random walk or not, that is whether the changes are predictable or not. The unpredictability of stock price changes means that the capital market is ready for the introduction of index funds.

The EMH exists in three forms the weak form EMH, the semi-strong form EMH and the strong form EMH as discussed above. These forms of EMH can be tested in the capital market and different types of statistical methods employed depending on the form of EMH being tested. This study tested the weak form of EMH in the NSE and tests applied were tests that are relevant to the level of EMH being analysed.

The assumption of the EMH is that investors act in a rational manner in investment decisions. This assumption has been heavily criticised by the behavioural finance school. This school tries to explain market anomalies that arise due to investors acting in an irrational manner. The anomalies have however been criticised as being unfounded because with or without the anomalies in an efficient market active fund managers have failed to beat the market consistently. Bodie et al. (2011) point out that there is an apparent inability by active managers to beat the market by taking advantage of these anomalies. This may cause one to doubt whether these anomalies can actually yield excess returns.

4.6.2. Dow theory

In contrast to the EMH, the Dow theory suggests the predictability of the stock market through the technical analysis. The technical analysts focus is on the primary trend of the market, the secondary trends and the price corrections that result from these movements with the aid of statistical methods. In other words, through the examination of trends within the market prediction of price behaviour can be made.

One of the major implications of the EMH is the futility of active fund management strategies to beat the market. Hence, it dismisses the application of the fundamental and technical skills utilised by active fund managers in the effort of beating the market. Technical analysis is heavily referred to when discussing the EMH, for this reason the Dow theory which explains Technical analysis is discussed. The theory is relevant to this study because it gives an in depth understanding of Technical analysis. Secondly, the Dow theory is referred to in the event that the NSE is not weak form efficient it then implies that technical analysis will be recommended as a fund management strategy and hence the importance of the theory.

4.6.3 The Adaptive Market Hypothesis (AMH)

The AMH is relevant in this study because of its relation to the EMH. It seeks to explain the limitations of the EMH and in the event that the NSE is not weak form efficient, the solutions suggested by the AMH may be adopted by the Kenyan capital markets. The EMH has received criticism from behavioural economists as well as from proponents of active fund managers. The AMH has sought to reconcile the traditional mainstream economists who suggest that investors act in a rational manner and the behavioural economists who suggest that this is not the case. The AMH calls for adaptability to the environment and recognises the role rationality and irrationality of investors in financial decisions. In other words, the AMH has been termed as the new version of the EMH.

4.6.4 The Modern Portfolio Theory (MPT)

The Modern Portfolio Theory (MPT) is relevant to this study because Index funds consider the main rule in investments to be diversification. The MPT advanced by Harry Markowitz in 1952 explains the reduction of risk through portfolio diversification. The theory is also relevant because it assumes efficiency of any given market for a successful portfolio to exist. This study analysed the informational efficiency of the NSE indices, for this reason the MPT is very relevant in the study.

4.7 Conclusions

In conclusion, the underlying theory of the EMH show the futility of active portfolio management and imply that portfolios should be managed passively in order to match the market performance. In the absence of superior managers, it is prudent to match the market at lowest costs through index funds that duplicate the composition of a market representative index and match the performance of that particular stock index in terms of returns (Reilly & Brown 2003). This chapter discussed the theories that underlie the study, including the Efficient Market Hypothesis, the Dow Theory, the Adaptive Market Hypothesis

and the Markowitz Portfolio Theory. The next chapter illustrates and discusses the conceptual framework. It also explains the relationship of the independent and dependent variables, the foundational theory of the study, and how these components interrelate with one other.

CHAPTER 5

A conceptual framework for the investigation of the suitability of the introduction of index funds in Kenya

5.1 Introduction

This chapter presents a conceptual framework that explains the independent variables of the study and the dependent variable of the study and demonstrates how they relate with one other. It also shows how the underlying theory interrelates with the variables. The independent variables are analysed to investigate market efficiency and to determine whether the indices are representative of the market. The presence of market efficiency and representativeness of the indices shows that it is favourable to introduce index funds (dependent variable). The conceptual framework aided the researcher to achieve the objectives of the study and forms a basis for the formulation and specification of models that will be estimated in order to empirically test market efficiency and market representativeness of the indices. Section 5.2 illustrates the conceptual framework, while Section 5.3 explains the conceptual framework by discussing the interactions of the NSE indices and market efficiency, and Section 5.4 further discusses the interaction of the indices and market representation within the conceptual framework, finally Section 5.5 gives an in depth discussion of the NSE indices as the independent variable of the study.

5.2 Conceptual framework

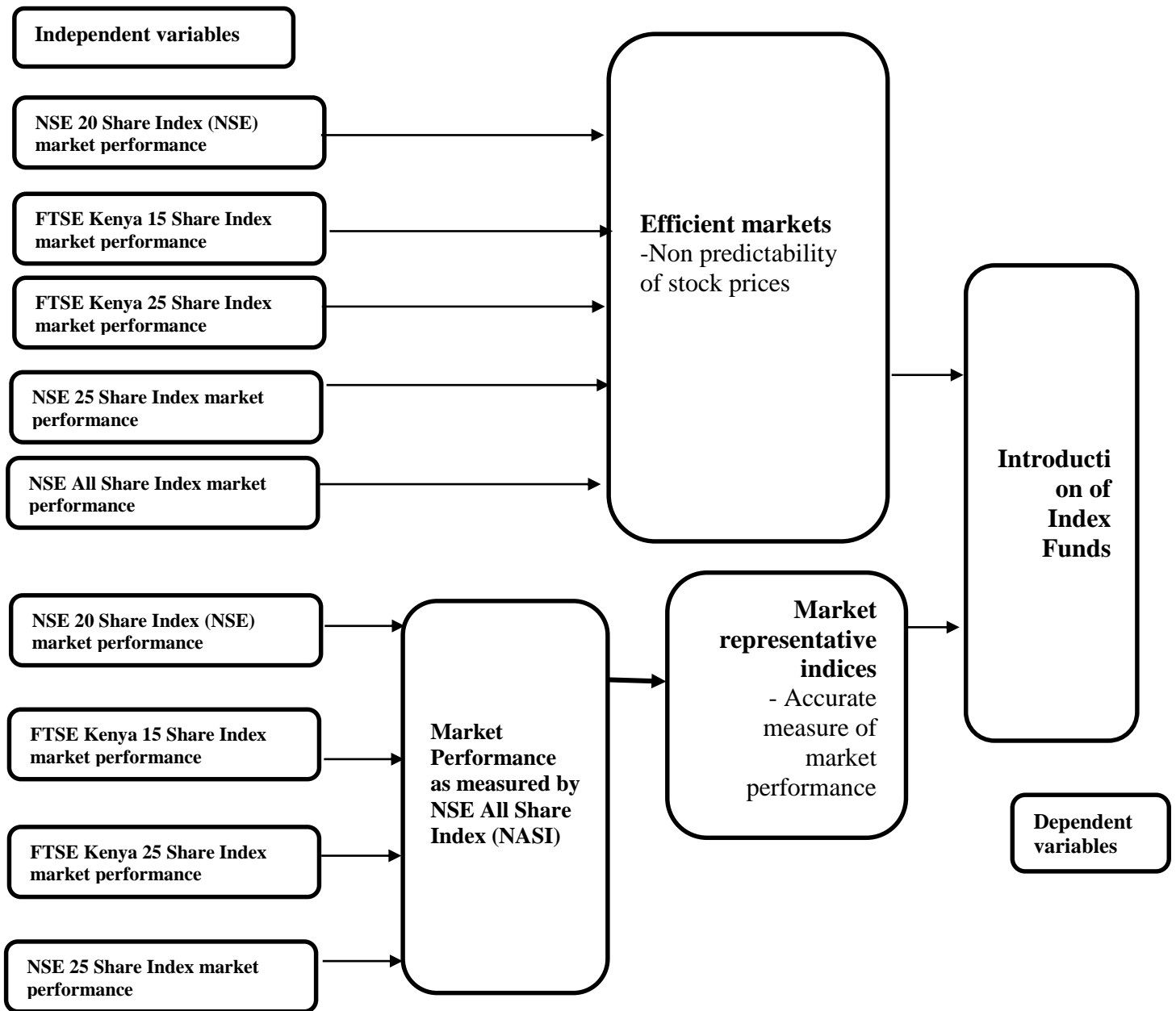


Figure 5.1 Conceptual framework for the investigation of the suitability of introduction of index funds in Kenya (Source: Own)

5.3 NSE Indices and market efficiency

This sub-section seeks to explain the interaction between the independent variables (indices), EMH and the dependent variable (introduction of index funds).

The foundational theory of the present study is the Efficient Market Hypothesis (EMH). Through the empirical analysis of the indices, the study set out to determine whether the NSE is weak form efficient. It is worthwhile to mention that, according to Kevin (2009:124),

“The efficient market theory holds the view that in an efficient market, new information is processed and evaluated as it arrives and prices instantaneously adjust to new and correct levels. Consequently, an investor cannot consistently earn excess returns by undertaking fundamental analysis or technical analysis”.

Index funds, as noted in earlier discussions, thrive in an efficient market where it is impossible to beat the market. For this purpose, the present study sought to determine whether the market is efficient enough for the introduction of index funds. To achieve this first objective, the NSE 20 Share Index, the FTSE Kenya 15 Share Index, the FTSE 25 Share Index, the NASI and the NSE 25 Share Index were used in the study as independent variables. The daily price returns of each index were analysed to find out the predictability of returns by assessing the dependency between the changes in returns. The indices are independent variables, because their non-stationarity determines whether introduction of index funds is possible or not. The analysis of the returns allowed for conclusions to be drawn as to whether the stock market is efficient or not.

5.4 NSE Indices and market representation

This sub-section seeks to explain the interaction between the independent variables (indices), market representation as measured by NASI and the dependent variable (introduction of index funds).

To achieve the second objective, the share indices were analysed to determine whether there is relationship between the indices and market performance as measured by NASI. Mogambi's (2017) study on the effectiveness of the NSE 20 Share Index in terms of representing the overall market performance correlated the NSE 20 Share with market performance as measured by the NASI. Similarly, the present study analyses the relationship between the share indices of the NSE; with the NASI, in order establish

whether the indices are market representative for the development of index funds. The daily share prices of the four indices were analysed using statistical tests to find out there is correlation in change in daily returns and the change in daily returns of the NSE All Share Index (NASI). The NSE All Share Index (NASI) was the variable that indicated performance of the entire stock market to which other indices were correlated, in order to determine the association between the variables. The study thus established whether the indices are market representative.

The NSE 20 Share was one of the independent variables analysed to determine whether there is a relationship between market performance by the 20 share index and the market performance as measured by NASI. This was done to establish its market representativeness and whether or not it can be used to develop index funds. The FTSE Kenya 15 Index and the FTSE Kenya 25 Index were similarly checked for relationships with market performance as measured by NASI to determine their market representativeness. The NSE 25 Share Index was likewise an independent variable in this study. The index was analysed to establish its relationship with the NASI, to establish its market representativeness for the creation of index funds in the NSE. If the indices are market representative, then it is feasible to create index tracking funds.

5.5 The NSE indices

Indices that are domiciled at the NSE are key in this study. Hence, a brief discussion of these indices is presented in this sub-section, to give a better understanding of the indices, as well as reference to the role they play in the conceptual framework. The importance of indices and their role in a stock market is discussed. The indices formulation is also discussed.

This study investigates the suitability of the introduction of index funds in Kenya. To this end, there are two objectives: to assess the weak-form Efficient Market Hypothesis for the Nairobi Securities Exchange (NSE), and to determine whether the current NSE stock indices are representative for the Kenyan capital market as stated in Chapter One of the present study. To achieve the first objective, the non-predictability of changes in the stock prices by exploring the dependence of the stock returns as expressed by the indices was examined. The second objective was achieved by establishing whether the indices available in the Kenyan capital market are market representative. This was achieved by exploring the relationship of market performance as measured by the NASI and with the market performance of other NSE indices.

The NSE (2020) defines an index as a measure of relative change that has occurred to a number of components for a period of time. There are seven indices that are domiciled at the NSE that measure these changes: the NSE 20 share index, NSE 25 share index, NSE All Share Index (NASI), FTSE NSE Kenya 15, FTSE NSE Kenya 25, FTSE NSE Kenya Govt. Bond index and FTSE ASEA Pan African Index.

This study utilised data from the NSE 20 share index, NSE 25 share index, NSE All Share Index (NASI), FTSE NSE Kenya 15, and FTSE NSE Kenya 25. This is because the study focuses on stock prices, and not bond prices. The study also focuses on analysing data from Kenyan companies, and for this reason the FTSE ASEA Pan African Index was not used. The FTSE ASEA Pan African index includes securities from different African nations listed at the African Securities Exchange Association.

Indices play an important role in the stock market. One of the points that emerged clearly in this discussion is the use of indices as a market performance measure. It has been noted that it is almost impossible to beat market performance as measured by a given index. Indices are also used in the construction of index funds and ETFs and for technical analysis purposes by technical analysts. Analysts use the indices to determine trends and make forecasts in active fund management. Reilly and Brown (2009:128) affirm that “a primary application is to use index values to compute total return and risk as a benchmark to judge the performance of individual portfolio”. Reilly and Brown (2009) likewise point out that technical analysts who believe in predicting future price movements use indexes to analyse price and volume changes. This leads one to believe that indices play a salient role in active fund management. Reilly and Brown (2009) indicate that the notion that active fund managers could not beat specified market indexes; they obviously mean that the alternative was to invest in a portfolio that mimicked an index, hence the creation of index funds and ETFs that track a given index. It follows that indexes are used for the construction of index funds and ETFs. This notion has resulted in investors shifting to index funds to take advantage of higher returns yielded by the funds. Finally, the indexes are used to measure aggregate market movements and the factors that influence these movements and to compare risk adjusted performance of different assets (Reilly & Brown, 2009).

The NSE 20 share index was the first share index to be introduced to the NSE, and it is one of the indices that are used in this study. Osoro and Jagongo (2013) explain that the first NSE index, the NSE 20 Share Index, has received criticism from stakeholders. As a result, the NSE All Share Index (NASI) was introduced in 2008 as a complementary index that constitutes all shares listed on the NSE.

According to NSE (2020), the NSE 20 share is a price weighed index that comprises of 20 of the largest securities valued by full market capitalisation. Reilly and Brown (2009) explain that indices are formed differently, and they are categorised according to the way they are formed. The three categories are the price weighted index, the value weighted index and the unweighted index. “A price weighted index is an arithmetic mean of current stock prices, which means that the index movements are influenced by the differential prices of the components” (Reilly & Brown, 2009:129). Although the NSE 20 share index is a price weighted index, it is also an equal –weighed geometric mean of 20 large ordinary stocks traded on the NSE (NSE, 2020). This proves that although this is a price weighted index, the mean is not calculated arithmetically but geometrically. Reilly and Brown (2009) note that a price weighted index, as much as high-priced stocks of large companies, carry more weight than low priced stocks. There is a downward bias for large companies when stocks experience splits. The stock price declines and the weight that the stocks carry within the index also declines even though the stock belongs to a large and mature company. Consequently, large companies dominate or control the NSE 20 share index changes.

There are rules guarding the inclusion of companies into any index, and companies must comply with certain requirements. According to the ground rules of the NSE (2020), for inclusion to the index a constituent must be a “blue chip” (with superior profitability and dividend record) with a minimum of Kes. 20 million. The shares of the company must have its primary listing on the NSE. In addition, the company should have at least 20% of its shares quoted on the NSE and it must be continuously quoted for at least 1 year. Time series data was obtained from the NSE 20 share index, and the percentage change of the daily closing stock prices was calculated. These percentage changes were used to determine whether the market is efficient, and whether the index is market representative for the introduction of index funds.

The NSE All Share Index is one of the most important index in this study. Apart from measuring the efficiency of the Bourse, the relationship between the NASI and other indices of the Bourse was analysed

to determine the market representativeness of the indices NSE (2021). The NASI was formed to represent the performance of all the 66 companies listed in the Bourse, providing investors with a comprehensive set of indices that measure the performance of the major capital and industry sectors of the Kenyan market. In addition,

“the NASI is designed to act as a barometer of the Kenyan economy with a view that companies listed on the NSE are good representatives of the sectors to which they belong. A major objective of the index is to provide the market with a composite report on market performance of constituent stocks so as to highlight general trends in the market and the economy at large” NSE (2021:3).

This leads one to assume that it is a good measure of market representativeness of the other indices. According to the NSE (2021), for companies to be part of the index, the following is required: A company must be listed under the Main Investments Market Segment (MIMS) or the Alternative Investment Market Segments (AIMS) of the NSE. There are no limits to the size, liquidity or free float. In addition, ordinary shares of all types can be included in the NASI, subject to conforming to all other rules of eligibility, free float and liquidity. Companies that have a full listing on the main board of the NSE are eligible for inclusion in the NASI, and cross-listed companies can also be included in the NASI.

Because of these, all companies listed on the NSE make up the NSE All Share. The index is calculated using the base-weighted aggregate methodology, which is also known as market value weighted methodology. This means that the index is reflective of the total market value of components stocks, and thus it is known as a composite index (NSE 2021). As a result, the NASI is a good indicator of market performance of the stock market and the market performance of the Kenyan economy. Reilly and Brown (2009) indicate that a value weighted index is derived from the initial total market value of all freely floating shares. The initial figure assigned to a base value or new market value is calculated, and a new base value is compared to the initial base value to determine the percentage change of the value. This shows that an index would have a new base value that will indicate market performance according to the index on daily basis. According to Reilly and Brown (2009), unlike the price weighted indices changes in stock prices and capital are adjusted in a value weighted index, because a decrease in stock price (due to stock splits, for instance) is offset by an increase in free-floating shares. Because of this, a percentage change of the value of a large company is of greater significance than a percentage change in market

value of a small company. Consequently, contrary to price weighted indexes, large companies do not dominate or control the index changes. Thus, the percentage changes in the index prices of the NASI are not heavily influenced by large companies.

In 2011, the NSE in collaboration with Financial Times Securities Exchange International launched the FTSE NSE Kenya 15, the FTSE NSE Kenya 25 indices. Time series data from the two indices were utilised. The NSE (2021) explains that the FTSE Kenya index series that are made up of the FTSE NSE Kenya 15 Index, the FTSE NSE Kenya 25 Index and FTSE NSE Kenya Government Bond Index was launched in 2012. Similar to the NSE 25 Share index, the FTSE NSE Kenya Index Series is designed to, “represent the performance of Kenyan companies listed on Nairobi Securities Exchange providing investors with a comprehensive and complementary set of indices which measure the performance of the major capital and industry segments of the Kenyan stock market” (NSE, 2015:3). This implies that the indices should provide a fair representation of the performance of segments that are used to construct it.

According to the FTSE indices fact sheet, the FTSE says that indices are calculated in accordance with the industry classification benchmark (ICB). In addition, these indices have been designed to be used as the basis for creation of index-based products such as ETFs and index tracking funds. This suggests that there are ready indexes within the NSE that are formulated for the purpose of product creation. The NSE (2021) notes that, “Constituents in the FTSE NSE are weighted by their investable market capitalisation (free float adjusted)” (NSE, 2021). The FTSE Kenya 15 index consists of top 15 most liquid stocks of the NSE ranked by a company’s full market capitalisation. Invest ability weightings are applied, and the index constituents are capped at 20-15% semi-annually (NSE, 2021:10). Therefore, for any company’s stock to be included in the index, they must comply with the liquidity, free float and invest ability criteria.

The NSE 25 share index was also utilised in this study. This is the youngest of all the indices domiciled in the NSE (NSE, 2021; Business Daily, 2015). The NSE Chief Executive, Mr. Odundo, launched another index in 2015 known as the NSE 25 Share Index. The NSE index was designed to represent performance of the companies listed on the NSE and therefore providing investors with alternative benchmark that was a measures of market performance and one which is comprehensive and complimentary (NSE, 2021). It must be noted that, similar to the NSE 20 share index, the NSE 25 comprises of a sample of shares from the Bourse and it is constructed by the NSE. Therefore, it makes

for a fair comparison with the NSE 20 and NSE All Share Index. The criteria for inclusion in this index are that the company must have capitalisation of Ksh. 1 billion and preferably be a blue-chip company. Furthermore, the company must be listed with the NSE, and at least 20% of its shares must have been quoted on the NSE for at least one year (NSE, 2021; Business Daily, 2015). The index is also calculated using the average prices of constituent securities as displayed on the NSE automated trading system (ATS) (2021). Therefore, this index is similar to the NSE 20 share index in that it is a price weighted index and large companies influence the movement of the index. Series data from the NSE 25 share index was utilised to check the market efficiency and market representativeness of the index.

5.6 Conclusion

The NSE indices are important in this study as they provide the necessary data for the research, hence the discussion above. Five of the NSE indices data is utilised in this study with an aim of utilising the indices for the introduction of funds and to check the efficiency of the NSE. According to the discussion, market indices are computed and formulated using different methodologies. The NSE 20 and NSE 25 share index are computed using price weighting. The FTSE NSE are weighted by their investable market capitalisation, and the NASI is a market value weighted index. The assumption of this study is that these differences in methodologies did not affect the outcome of market representation of the indices, neither did it affect the analysis of dependability of changes in returns.

The conceptual framework as illustrated in Figure 5.1 explains the interrelation of the independent variables, the EMH, market representation and the dependent variable. To achieve this first objective, the NSE 20 Share index, the FTSE Kenya 15 Share Index, the FTSE 25 Share Index, the NASI and the NSE 25 Share Index are used in the study as independent variables. The daily returns of each index were analysed to find out the predictability of returns. Introduction of index funds is the dependent variable. To determine whether the current NSE stock indices are representative of the Kenyan capital market, the FTSE NSE 15 index, the FTSE NSE 25 index, the NSE 20 and the NSE 25 index were independent variables, while the introduction of index funds was the dependent variable. The change in the daily returns calculated from the daily prices of the four indices were analysed to check their relationship with the NASI daily returns changes. The conceptual framework guided model specification as further discussed in the next Section which focuses on research methodology and methods of the study.

CHAPTER 6

Research methodology and methods

6.1 Introduction

The purpose of this chapter is to discuss and present the research methodology and methods that are applied in the investigation of the suitability of introducing index funds in Kenyan capital markets. The data used and the models that are implemented in this study are discussed.

This study adopts a post positivist stance. This stance informs the research approach, which is a quantitative approach. Data was collected from the NSE data streams and the FTSE Russel data streams. This data comprises indices data, and is therefore time series data. A longitudinal correlational research design was adopted for this study. Variables were tested to check for dependency between variables; that is, whether one variable can predict another variable at time t and $t-1$.

The chapter is structured as follows: Section 6.2 presents the philosophical research paradigm, and Section 6.3 presents the research methodology. Section 6.4 explains the research approach while 6.5 presents an overview of the broad research approach followed. Section 6.6 presents issues pertaining to the data, including how the data was collected, sampling of the data as well as data management procedure. Section 6.7 presents the data analysis procedure followed to determine the suitability of introducing index funds in Kenyan capital markets, which is based mainly on time series and econometric methods. Section 6.8 presents the preliminary data analysis. Section 6.9 explains the model specifications for assessing the weak form Efficient Market Hypothesis (EMH) for the Nairobi Securities Exchange (NSE). The serial correlation test and the variance ratio test are explained in this section as well. The section also presents the linear unit root tests and the nonlinear unit root test which test non stationarity of the data. Section 6.10 discusses model specifications for determining whether the current Nairobi Securities Exchange (NSE) are representative for the Kenyan Capital markets. Section 6.11 sets out the analysis procedure and, finally, Section 6.12 outlines research ethics issues relevant to the present study.

6.2 Research philosophical paradigm

A paradigm is a way of thinking which forms the basis of our action. It is a basic set of beliefs that guides action (Cannella & Lincoln, 2011). It aims to explain (a) how the world works, (b) how knowledge is

excavated from the world, (c) what questions can be asked, and (d) what methodologies can be used to answer these questions (Dills & Romiszowski, 1997).

A research paradigm is defined as the philosophical intent or motivation for conducting research. It is a collection of logically related concepts, propositions, and assumptions that guide research and thinking (Cohen & Manion, 1994). Corbetta (2003) summarises Kuhn's (1962) extrapolation of a paradigm, describing it as a theoretical perspective that is accepted by scientists in a given discipline, and which basically guides the entire research endeavour. It can be deduced that a paradigm is a way of thinking, a point of view, stance or a way of acquiring knowledge. Corbetta (2003) further emphasises that a paradigm is salient when developing acceptable research techniques. In addition, Scotland (2012) explains that every paradigm consists of the following dimensions: ontology, epistemology, methodology.

In addition, every paradigm has its own epistemological and ontological assumptions and methodological choices. Thus, there are diverse assumptions about reality and knowledge which underpin the research approach. This approach, in turn, reflects on methodology and methods chosen. Scotland (2012) defines ontology as assumptions that are concerned with what constitutes reality and adds that researchers need to reflect on their positions of how things work and how they really are.

Wasik (2016:24) expounds on epistemology as, "a branch of philosophy that studies the nature and grounds of knowledge with regard to the scope and functional validity of investigative approaches used in particular disciplines for determining their subject matter, it also includes theoretical axioms and hypothesis that underpin or result from such investigation". This study follows an epistemological stance. This stance is an investigative approach that seeks to address the research questions on determining weak Efficient Market Hypothesis (EMH) and market indices' representativeness with particular focus on the Kenyan market.

The identification of a research paradigm is one of the first steps in any research project, and it is one of the foundations of a study. The paradigm directs how an empirical study is conducted. It is the basis for the choice of a research approach, and the research approach informs the choice of the research design and methods. This leads one to conclude that a research paradigm is a way of thinking and understanding

that guides the acquisition of new knowledge in the context of a research problem. It is the way in which a researcher seeks to understand concepts and principles underlying a research problem and develops new knowledge concerning a phenomenon. There are several research paradigms, including the interpretive or constructivist paradigm, critical or transformative paradigm, pragmatic paradigm, and post positivism paradigm. The paradigms are briefly explained in the following subsections.

6.2.1 Interpretive or constructivist paradigm

The constructivist paradigm or interpretive paradigm, as the name implies, has to do with interpretation. According to Creswell and Creswell (2018), the constructivist paradigm was developed by Berger and Luckmann (1967) as well as Lincoln and Guba (1985) and also recent scholars such as Lincoln and colleagues (2011), Mertens (2010) and Crotty (1998). In addition, Creswell and Creswell (2018) state that individuals develop subjective meaning towards experiences, objects, phenomenon and these meanings are different and specific to each individual. This means that, in order for a researcher to understand a research problem, he or she must understand the meanings attributed to the problem by the participants of the study. Creswell and Creswell (2018) add that the goal of the researcher is to rely on participants' views and that open-ended questions are more relevant in certain contexts. The writers recognise that the researcher has his or her own way of interpreting meaning, and this should be clearly stated in the study, because the researcher's way of understanding influences the research procedure and outcomes. It can be concluded that this kind of research is more suitable for a qualitative study, since it is the views of individuals that are being considered. The authors note that this paradigm is regarded as a suitable approach to qualitative research.

6.2.2 Pragmatic paradigm

Pragmatic means practical; it is being practical when conducting research. Creswell and Creswell (2018) affirm this notion and state that a pragmatist is not committed to either quantitative or qualitative methods or approaches towards solving a problem. The main focus of the researcher is that the problem is solved, and to this end, one can apply both quantitative and qualitative methods where deemed most applicable. Therefore, in this paradigm, the researcher puts greater emphasis on the research problem and to select a research method that can solve the problem. In addition, Creswell and Creswell (2018) recognise that this paradigm relates to mixed methods. Pragmatism was derived from the work of scholars such as Murphy (1990), Patton (1990) and Rorty (1990).

6.2.3 Critical or transformative paradigm

The critical or transformative paradigm seeks to bring change to social-political issues. Creswell and Creswell (2018) note that this paradigm was proposed by scholars who found that post positivism did not address issues of marginalised groups who were discriminated against, neither did it address socio-political issues. This is because of the laws and theories that post-positivism imposed. Proponents of this paradigm feel that constructionists did not address marginalised people's issues, neither can the constructionist paradigm bring transformation to social or political issues.

This paradigm borrows heavily from works of Marx, Adorno, Marcuse, Habermas, and Freire (Neuman, 2009). Fay (1987), Heron and Reason (1997), Kemmis and Wilkinson (1998), Kemmis and McTaggart (2000), and Mertens (2009, 2010). This implies that research based on this paradigm should aim to bring about changes or solutions or transformation to the problem at hand. Thus, it follows that there should be social, political transformation after a research project has been conducted. Creswell and Creswell (2018:47) affirm that, "the research in the transformative worldview links political and social action to these inequities. Transformative research uses a theory of beliefs about how a program works and why the problems of oppression, domination, power and relationships exist."

6.2.4 Post-positivism paradigm

This study is approached from a post-positivism stance. Gall et al. (2007:16) define positivism as an, "epistemological doctrine that states physical and social reality is independent of those who observe it and observation of these realities if unbiased constitute scientific knowledge". In addition, the authors explain that positivism regards something as meaningful if it can be observed objectively and can be verified. The researcher's subjective views have no place in positivist scientific inquiry. This implies that research done from this stance is objective and the research is not affected by the researcher. Hence, the researcher distances himself or herself from any impact of their research results. Scotland (2012:10) further adds that, "the positivist epistemology is one of objectivism". The author notes that positivists go forth into the world impartially, discovering "absolute" knowledge about an objective reality. The researcher and the researched are independent entities. Scholars (Neuman 2006; Gall et al., 2007) explain that a positivist stance influences quantitative research. Quantitative researchers tend to aim to be objective and avoid influencing the data collected: they detach themselves personally from participants

and they tend to study a sample or a population for objectivity purposes. Quantitative research is synonymous with positivist research paradigm (Gall et al., 2007).

The positivist paradigm has evolved from the 1930's to 1960's and developed to neo-positivism and then, later, into most recent form – that of post-positivism. The post-positivist paradigm was developed by scholars such as Comte, Mill, Durkheim, Newton, and Locke, Smith, and Phillips and Burbules (Creswell & Creswell, 2014).

Post-positivism concerns thinking after positivism, which challenges the notion of absolute truth. Corbetta (2003:19) explains the developments of post-positivism and states that, “despite the assumption that reality exists independently from the cognitive and perceptive activity of humans, the act of understanding remains conditioned by the social circumstances and the theoretical framework in which it takes place”. Thus, there is the implication that understanding reality is affected by social and theoretical views of the research and the researcher. It simply means we cannot be absolutely positive of our claims to knowledge or truth. The author adds that, “the new positivism redefines the initial presuppositions and the objectives of social research; but the empirical approach, still utilises the original observational language, which was founded on the cornerstones of operationalisation, quantification and generalisation”. Thus, post positivism is a modification of the positivist paradigm, and at its core it utilises conceptual framework, observational techniques and mathematical analysis and inference procedures. According to Creswell and Creswell (2014), post-positivism is also referred to as the scientific method, science research, post positivist research, or empirical science.

In addition, Creswell and Creswell (2018) explain that post-positivism is a deterministic philosophy in which causes determine effects or outcomes. Therefore, the problems studied by post positivists concern identifying and assessing the causes that influence outcomes. It is also reductionist, that is, it tests ideas in small sets such as variables and knowledge that is acquired from a post-positivistic stance is based on measurement of objective reality. Creswell and Creswell (2018) conclude that in this approach, a researcher would start with a theory, then collect data that either supports or refutes the theory, and then offer revisions and or conducts additional tests.

As mentioned earlier, the present study adopts a post-positivism stance. This is because this study tests whether NSE indices are weak form efficient. The study is guided by the underlying theory which is the Efficient Market Hypothesis (EMH). This means testing of theory on the Kenyan NSE will be done. Indeed,

“The Efficient Market Hypothesis holds the view that in an efficient market, new information is processed and evaluated as it arrives and prices instantaneously adjust to new and correct levels. Consequently, an investor cannot consistently beat the market and earn excess returns by undertaking fundamental analysis or technical analysis” (Kevin, 2009:124; Block & Hirt, 2002:416).

According to this hypothesis, an efficient market is one in which prices are affected by new information, price changes occur as information arrives in the market, and these in their turn affect returns. Earlier discussions in the theoretical framework chapter referred to three levels of EMH. These levels are the weak form, the semi-strong form and the strong form of EMH. The weak form of EMH, which is the first level of informational efficiency (EMH), was tested in this study. This level of efficiency is tested in two ways: through statistical tests of independence in changes of stock prices (and if independency is established, then technical and fundamental analysis are of no value) (Jones, 2010). These tests include tests like the runs test and serial correlation tests (Reily & Brown 2009; Bodie et al., 2010). This study tested independency in stock returns through statistical tests. The second way of testing weak form EMH is explained by Bodie et al (2010) as using tests of trading rules. These trading rules are used by analysts who analyse past data. If the rules ascertain returns that are above a passive benchmark, then the market is not efficient. Tests of trading rules are not applied in this study. Thus, to test weak form efficiency of the NSE, daily returns of all indices were analysed to check for randomness of changes in returns.

The study is hinged on market returns of the data used in the study. Market returns data are numerical, which is a form of quantitative data. Therefore, a post-positivist stance was adopted, because this is quantitative research in which quantitative data is utilised. The numerical data was analysed to determine whether the returns behave randomly or not. Secondly, a post-positivism stance was chosen because objectivity was required for this study. The research involved testing an aspect of a theory, that is the weak form of the EMH, which was achieved through analysis of indices data. The researcher’s study and results that led to conclusions were independent of the researchers’ subjectivity. Thirdly, the researcher

chose to carry out the research empirically, and thus it is scientific. Also, the study is scientific in nature in that it involved the collection of data and applying the appropriate research methodology to achieve the objectives. This advised the choice of the chosen stance. As much as the study was influenced by social conditions and the theoretical framework in which it is situated, objectivity was consistently applied in the interpretation of results.

The assumptions of the post-positivist stance, according to Phillips and Burbules (2000), include the notion that an absolute truth does not exist and can never be found, and thus evidence established in research can have errors. Secondly, the authors note that research is the process of making claims and then refining or abandoning some of them for other claims that have stronger evidence. Thirdly, rational considerations shape knowledge. Fourthly, research seeks to develop relevant, true statements, and objectivity is an essential aspect of competent inquiry. This study observes these assumptions.

6.3 Research methodology

A research methodology refers to the way in which a research project is done. According to Kothari (2004), research methodology entails the science of studying how research is conducted. It is a way to solve a research problem step by step. It may be understood as a science of studying how research is done in a scholarly context. In other words, it is a plan of how the research problem is studied and the methods that will be used and why the choice of the methods. Thus, it is a clear outline of how the research is carried out to answer research questions.

Kothari (2004) further explains that, “when we talk of research methodology, we not only talk of the research methods but also consider the logic behind the methods we use in the context of our research study”. As a result, the methodology used in this study has sound logic behind it. Good research, according to Kothari (2004), is logical research; that is, it should have good reasoning behind the decisions made while conducting the research and the methods chosen for the research. The author adds that good research should be systematic, which implies that there is a step-by-step procedure of conducting the research; the research should be empirical (meaning that it is primary research); and good research should also be replicable, which implies that the research can be verified by other researchers.

This research is empirical and can be replicated, because it involved collection of primary quantitative data. Tharenou et al. (2007) state that empirical research concerns studies in which data is collected to assess relationship between variables. Kothari (2004) adds that empirical research is data-based research

where experiences are verified using observation or experiment, where first-hand data is obtained at source and required information is obtained from the data. The author further argues that in this kind of study, the researcher must develop the research questions, then move to obtain relevant data to answer the questions. Also, Tharenou et al. (2007) explain that empirical studies seek explanations regarding a variable, resulting in the analysis of data to determine relationships between one or two or several variables, if and how they affect each other.

Research methodology has to do with how a research project is carried out to solve the research problem at hand. It entails the steps taken and methods implemented to find answers to the research questions. There must be clear reasoning behind the choice of methods used and steps followed during the research. In order to investigate the suitability of introducing index funds in the Kenyan capital market, there is a clear laid out strategy and procedure on how this is to be achieved. The logic behind the methods and procedure used are explained in this section. This study has qualities of good research, in that it is empirical because numerical data is used and relationship between variables is analysed. Secondly, it is systematic; that is, the research follows a procedure to achieve the objectives of the study and thirdly, this study can be replicated. The methodology implemented in this study is illustrated and explained in Figure 6.1:

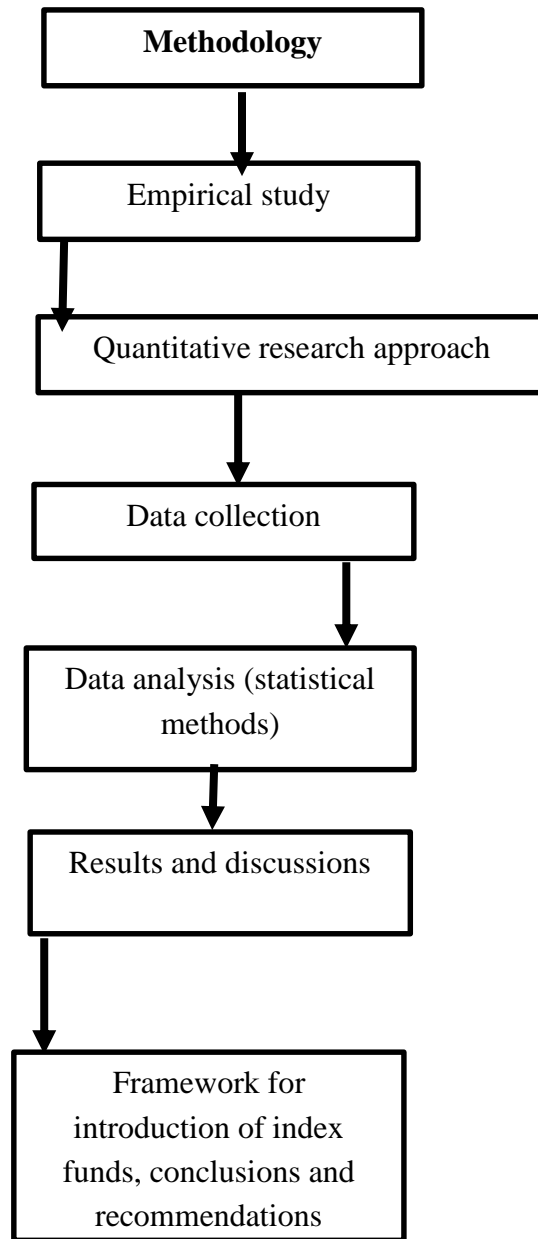


Figure 6.1: Research methodology process (source: own)

This study is an empirical study, because it is a primary study where numerical data is collected and relationships of variables analysed. A quantitative research approach was chosen for this study, because it is informed by the choice of paradigm, the data collected, and the study's aim being objectivity. Data collection is the next step of the study. Numerical data was collected and the relationship between the variables is studied to establish whether the NSE indices are weak form efficient and whether the indices are market representative. The relationship between variables was studied by means of statistical

methods, which include the use of time series and econometric methods. Results are presented and the discussions thereof given. T allows the framework for the introduction of index funds to be formulated. The conclusions and recommendations of the study are finally discussed.

6.4 Research approach

There are three approaches to research: qualitative, quantitative and mixed methods research. These approaches differ in terms of the kind of data utilised, methods of analysis, sampling techniques used, and focus of the research studies.

6.4.1 Qualitative research approach

Qualitative research involves the collection of qualitative data. This type of research is defined as research that involves non-numerical data, for example written texts or documents, visual images, interviews, observation of behaviour, or case studies (Remler & VanRyzin 2011). Qualitative research interprets information that is given by participants using different interpretation methods. Therefore, interpretation by the researcher and research participants may lead to subjectivity. Remler and VanRyzin (2011) explain that qualitative research uses various methods of analysis for interpretation because this kind of data is mostly written or spoken. The language that is used in qualitative research provides an understanding of thoughts, experiences and motivations of participants that lead to inter subjectivity. So a study can be influenced by the researcher's way of understanding and views of the research problem.

Qualitative research approach involves seeking a deeper understanding of a particular phenomenon through understanding meaning ascribed to it by participants. Mugendi (2008) explains qualitative research as type of research that refers to a variety of research approaches conducted in natural settings. The philosophical assumptions underlying qualitative research is that reality has many facets, that reality might not be measurable, and cause and effect might not be established. The author adds that qualitative research is subject to the interpretation of meaning of events on individuals experiencing them (Mugendi, 2008). Moreover, Creswell and Creswell (2018) note that qualitative research seeks to understand meanings that are ascribed to human problems by individuals or groups. Data is collected in participants' setting and the researcher interprets the meaning of the data. Researchers applying this approach tend to honour an inductive style, to focus on individual meaning, and to take cognizance of the importance of reporting the complexity of a situation.

Mugendi (2008) emphasises that qualitative research is aimed at understanding meanings that events have on participants in the research, and designs involved in this approach are flexible. Qualitative research focusses on groups, individuals, or institutions and through this understanding, leads to finding answers to pressing problems. It also can lead to the generation of variables and exploring relationships between variables, thus the generation of theory and models that can lead to uncovering of possible causes and causal mechanisms (Remler & VanRyzin, 2011).

6.4.2 Quantitative research approach

This research study adopted a quantitative research approach. The study is approached from a post-positivist philosophical stance, which suggests the choice of a quantitative research approach. This is because the methodology is directed by the research paradigm which is concerned with how the problem will be studied (Corbetta, 2003). Quantitative research is synonymous with a positivist research paradigm (Creswell & Creswell, 2018; Gall et al., 2007). The choice of a post-positivistic stance is influenced by the underlying theory, which is the Efficient Markets Hypothesis (EMH).

Quantitative data is utilised in this study. The quantitative research approach is synonymous with quantitative data. According to scholars (Gay et al., 2009; Koop, 2009), the data utilised for quantitative research is numerical. The present study utilises numeric data, which is daily index price data. In addition, Remler and VanRyzin (2011) define quantitative research as research that produces numerical data that can be retrieved, including prices, accounting data, or numerical data that represents various characteristics, behaviours or attitudes.

Secondly, the collected data in this study is numerical and as a result, statistical methods were utilised for analysis, and both descriptive and inferential statistics were used. Creswell and Creswell (2018) note that the use of statistical methods is synonymous with quantitative research. In addition, scholars (Gay et al., 2009; Koop, 2009) describe quantitative research as research approaches that are applied to describe present conditions, and to investigate relations and cause effect relationships. Data utilised for this kind of research is numerical and relies on statistical procedures for analysis. Remler and VanRyzin (2011) support this notion by stating that researchers using this approach apply statistical methods that range from simple graphs to more complicated statistical techniques. Consequently, the descriptive and inferential statistics is used in quantitative analysis. Scholars (Fortworth, 1994; Lind et al., 2011) explain descriptive statistics as summaries of information that describes a sample or a population. It is concerned

with using various methods to organise, summarise and present information on the numerical data being analysed in an informative way. Descriptive statistics makes this information easy to understand and interpret. It is used to make judgments about a population based on a sample. It involves the presentation of distribution tables, distribution graphs, and calculation of averages among others. Inferential statistics or statistics inferences, on the other hand, are methods used to estimate a property of a population on the basis of a sample. It entails inferences about a population based on sample data (Fortworth, 1994; Lind et al., 2011). Inferential statistics is a “best guess” of a population value based on a sample information (Lind et al., 2011).

Quantitative research tends to be very objective, because the researcher reports the results as they are. Quantitative research is thus synonymous with objectivity. Creswell and Creswell (2018) explain that quantitative research is an approach for testing objective reality, and the present study is an objective one. Moreover, post-positivism and positivism are identified with objectivity. Various scholars (Neuman, 2006; Gall et al., 2007; Creswell and Creswell, 2018) explain that positivism influences quantitative research, in that quantitative researchers tend to be objective and avoid influencing the data collected. Such researchers detach themselves personally from participants, and they tend to study a sample or a population for objectivity purposes.

The present study aimed at objectivity, and results were obtained by means of applying scientific principles. This approach is advised by the research paradigm that assumes a reality that is observable, measurable, and can be explained. The study is objective, inferences were made, and the researcher did not influence the results. To emphasise the scientific nature and objectivity of studies that have been done from this approach, scholars (Creswell and Creswell, 2018; Corbetta, 2003) comment that the post-positivist stance ensures objectivity of the study and methodology used. These are quantitative in nature, and statistical methods are applied. It follows that this study utilised statistical models to analyse the numerical data.

Quantitative research seeks to give answers to research questions by analysing relationships between variables that are numeric. This research tested an aspect of the EMH, namely the weak form of EMH, thus the testing of an objective theory. Testing theories is synonymous with quantitative research. Creswell and Creswell (2018:41) note that, “quantitative research is an approach for testing objective

theories by examining the relationship among variables”. Furthermore, Mugenda (2008) explains that, “quantitative research attempts to quantify social phenomenon by collecting, analysing and interpreting numeric data focusing on the links among smaller number of attributes across many cases”. This justifies the notion that variables, as pointed out in the conceptual framework, were analysed using statistical methods that are discussed in this chapter. In addition, Creswell and Creswell (2018) point out that quantitative research analyses variables that are numeric, so that the variables can be measured through statistical procedures. Theories in this regard are mostly about variables and how they are related to each other (Remler & VanRyzin, 2011).

6.4.3 Mixed method research approach

Mixed methods involve the use of two methods. Creswell and Creswell (2018) point out that this method uses both qualitative and quantitative methods. The assumption is that through the use of two methods provides in-depth information about a phenomenon. It involves the collection of both quantitative and qualitative data. Therefore, the use of both methods enhances one’s understanding of a research problem. In addition, Remler and VanRyzin (2011) explain that a cycle of research can be employed in a given research situation, where a researcher could seek to explore a problem through qualitative observations and later on seek more information through quantitative techniques and back to qualitative observation until the problem is resolved. Mixed methods are used in circumstances where the choice of one method would not result in satisfactory or adequate findings on a research problem.

In summary, this study utilised quantitative approach to achieve its objectives. The quantitative approach is guided by the post-positivist stance that is adopted in the study. The post-positivist stance is informed by the underlying theory of the study, which is the EMH. As a result, secondary numerical data was collected and analyses were conducted using statistical models to establish relationships between variables and draw conclusions.

6.5 Broad research approach

This study adopts Creswell and Creswell’s (2018) broad approach to research. This approach consists of four components: the philosophical stance, the research approach (which could be qualitative, quantitative or mixed methods); the research design and the specific research methods. The philosophical stance in this study is informed by the underlying theory and the research approach is informed by post-positivism. In turn, the research design and research methods are influenced by the research approach

and the philosophical stance. Creswell and Creswell (2018:43) emphasise that researchers need to make decisions on the underlying philosophical worldview-related assumptions of a study and of the research design, both of which are informed by the philosophical worldview and the specific methods that are utilised in the study. This study adopts the overall research approach suggested by Creswell and Creswell (2018) as illustrated in Figure 6.2.

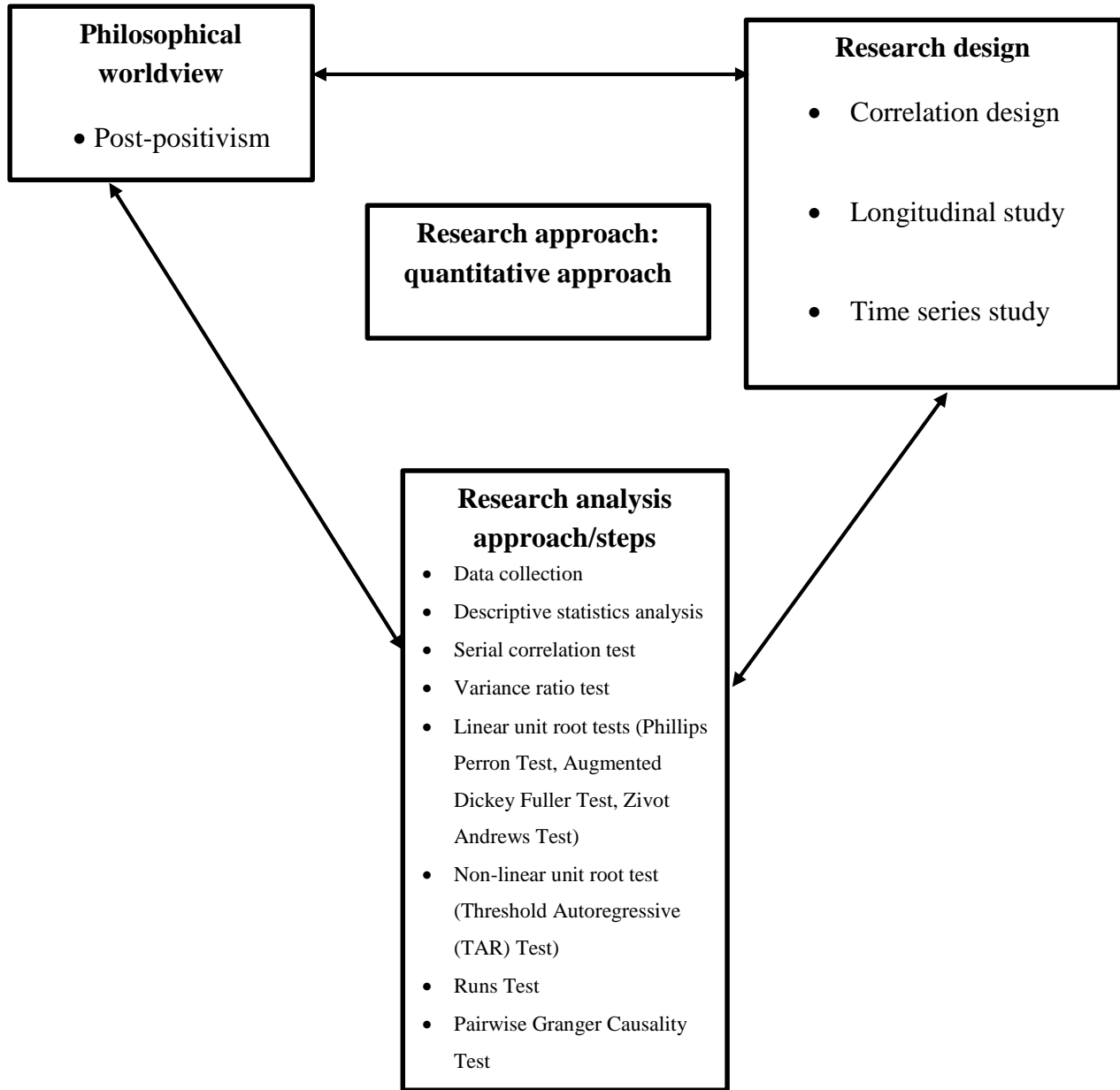


Figure 6.2 Overall research approach (source: Creswell & Creswell, 2018)

6.5.1 Research design

A research design is a plan or roadmap of strategies of how a research problem will be approached and resolved. It outlines the procedures that will be used for data collection and analysis. Cooper and Schindler (2006) describe the research design as the blueprint for fulfilling research objectives and answering questions. It entails the organisation of how to collect data in a manner that makes the research

purpose relevant, keeping in mind economy of procedure. It is the conceptual framework within which research is conducted. Mugendi (2008) points out that a design is a process of how a study will be conducted, from the beginning to the end, using specific methods. The author adds that different methods are applicable to different types of research. This means that specific research methods are relevant to specific paradigms and research designs. A further explanation by Kothari (2004) suggests that a research design answers the questions of decisions regarding what, where, when, how much, and so forth in a research study. It is the conceptual structure within which research is conducted, and it guides the collection, measuring and analysis of data.

The research design used in this study is important, because it provides a clear guide for the researcher to follow, it enabled proper planning for the research activities, and adds weight to the reliability of the results. Kothari (2004:32) notes that a, “research design is needed because it facilitates the smooth sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money”. The design also provides a guide to those who would wish to replicate the results in the future and enable critics to have a comprehensive review of the study.

The design chosen for this study considered the aim and nature of the research problem, how to obtain the relevant data for the research; the skill of the researcher and the availability of resources for the research. Kothari (2004) points out that in order for a research design to be considered effective, a few things must be considered: (i) how the information is obtained, (ii) the skills of the researcher (iii) his or her availability, (iv) the aim and nature of the research problem, (v) the time framework and (v) financial resources available for the research.

Research designs are specific to research approaches. The research approach in this study is quantitative in nature. There are specific designs that apply to quantitative approach. Creswell and Creswell (2018) advise that a researcher not only makes a choice on which research approach to follow, but also chooses the design to be applied under the specific approach chosen. The design provides specific direction for procedures in a research study. Quantitative research designs include a descriptive research design, a correlation research design, an experimental research design and a causal-comparative or quasi

experimental design. The following paragraphs discuss these research designs as applied in quantitative studies, as well as the specific design chosen for this study.

6.5.1.1 Descriptive research design

A descriptive research design is a foundational design that seeks to understand an issue within a community and enables further research issues or problems facing a community to be conducted. Mugenda (2008) notes that descriptive studies are carried out within specific communities and specific regions in an effort to investigate problems in that community. This geographical limitation suggests accessibility and simplicity as requirements of such a study. Furthermore, Mugenda (2008) states that descriptive studies tend to point out problems that require further investigations and from this basis experimental and correlational studies can be conducted. It may be inferred that this kind of study is not sufficient to solve a problem and further investigation may be required or may be prompted to understand the problem in greater depth. In addition, Mugenda (2008) explains that at this level of study, hypotheses may be generated that can be tested in further studies.

Since this is a descriptive study, descriptive statistics are mainly utilised. According to Mugenda (2008), measures of central tendency that is the mode, median, and mean are mainly used. In addition, measures of dispersion, that is, the standard deviation and variance, are commonly used statistics. Deviations from the norm can provide insight into the problem at hand, and indicate interventions. From this perspective, the researcher can deduce interventions that are required and indicate whether further studies are necessary.

Relationships between variables can also be measured in descriptive studies. Mugendi (2008) mentions that this can be achieved through measurements of association, for instance the bivariate Pearson Product-Moment Correlation coefficient. This can illuminate the kind of relationship between two variables and what kind of interventions are required to resolve the problem.

6.5.1.2 Experimental research design

Experimental research designs involve the study of variables in an environment that is controlled to find out the behaviour of variables. This is explained by Mugenda (2008) in that the purpose of experimental research is to establish cause and effect relationships between variables through the manipulation of variables. This manipulation of variables makes it the preferred research design in physical and biological

science. Manipulation may include control of lighting, moisture and nutrients control, control of treatment administered to patients.

Experimental studies choose participants through the application of random sampling techniques. Mugenda (2008) notes that randomisation, pretesting and post-testing of experimental participants and control participants is practiced in a true experimental design. Randomisation ensures that participants are similar at the onset of an experiment, and this leads to homogeneity of variance. This randomisation of participants to groups is known as blocking, which reduces variations to allow for greater precision in finding out the sources of variation. Therefore, experimental studies can produce superior results if implemented under the right conditions and if necessary measures are in place. In addition, variance from measures of central tendency is reduced.

6.5.1.3 Quasi experimental research design

A Quasi experimental research design is similar to experimental research in that the participants are subjected to manipulation of variables; however, it is not possible to manipulate all the variables that require manipulation. Mugenda (2008) notes that quasi experimental a research design is normally used in social sciences where project assessments are conducted. In this kind of research, the manipulation of variables and extraneous factors is limited. This is due to circumstances that are beyond the investigators' control that present themselves. Also, ethical considerations control the extent of manipulation of variables. Extraneous factors that are beyond the researcher's control may affect the investigation to the extent that findings or results of the study are inaccurate. This is known as de facto conditions in research.

Sampling methods constitute another differentiating factor between the causal-comparative research design and experimental research design. According to Mungenda (2008), the random assignment of subjects or units to experimental and control groups is not applicable to quasi experimental designs. Participants in social projects are different in a variety of ways, making it difficult to obtain equivalent groups. Thus, the choice of participants in such a study might be subjective. Therefore, concern is has been voiced over the choice of participants in quasi experiments.

6.5.1.4 Correlational research design

A correlation design is defined as a measure of the degree of association between two or more variables. The concept was advanced in 1888 by Galton, who named the correlation coefficient after Karl Pearson.

It is referred to as the Pearson Product-Moment Correlation Mugenda (2008). Correlation assesses relationships among variables, and it is based on the premise that if significant relationships exist between variables, then it is possible to make predictions of one variable using available information on another variable. Correlation invokes no manipulation and makes associational (relationships) inferences (Mugenda, 2008). This kind of design is therefore objective. Furthermore, Tharaneou *et al.* (2007) add that correlational studies are used to test hypotheses or research questions on large sample of peoples, to examine relationships between variables, and to test theories that include independent, dependent and moderator variables. It is also use to generalise findings or results through large samples, to test questions when there is a solid literature base, and to assess the effects of several variables. However, cause and effect relationships are effectively established through experimental research, but this does not mean that correlations do not indicate causal relationship.

Correlational designs can be longitudinal, according to Mugenda (2008). A longitudinal design involves the observation of the sample at intervals over a specified period of time. Observations are made on a single phenomenon over multiple periods of time, and thus they are more powerful than cross-sectional studies because they exclude time invariant unobserved individual differences and temporal order of events. It follows that the observer can determine whether the independent variable can actually predict the dependent variable. Longitudinal data has a time lapse between the dependent and independent variables, allowing for reverse effects to be tested (Tharaneou *et al.*, 2007).

This study adopted the correlational research design, because it measured the relationships between variables. For the first objective, randomness of the change in returns of given indices' securities as described in Chapter Four were measured, the independent variable being the NSE indices and FTSE NSE Kenya indices, and the dependent variable being weak form efficiency. The second objective measured the relationships between the dependent variables the NSE 20 share index, the NSE 25 share index, the FTSE NSE Kenya 20 and 25 share indices and the independent NSE All share index were measured. The second reason for the choice of this research design is the fact that this project set out to test the weak form of the efficient market hypothesis. Correlational design is synonymous with testing theories.

This study applied a correlational design that was longitudinal. Time series data, which means longitudinal data, was used in this study. This kind of data allows for a time lapse between dependent and independent variables. This enabled the researcher to analyse for predictability of the dependent variable by the independent variable. Longitudinal studies' strengths include uncovering of predictors by longitudinal studies, and because of repeated observation, they are more powerful than cross-sectional studies. This is because they can remove time –invariant unobserved individual differences as well as the temporal order of events Mugenda (2008).

6.6 Data

6.6.1. Data collection

The data collection in this study followed a number of steps advised by Montgomery et al. (2011). The authors describe data collection steps as involving planning of how the data will be collected, how the data will be stored, how the data will be prepared for analysis and the steps that will be taken to ensure that the integrity and reliability of data is maintained. Data that was used in this study was publicly available data. Part of the data, consisting of NSE indices, was obtained from the Bourse data streams. In addition, the FTSE NSE Kenya 15 Share Index and the FTSE NSE Kenya 25 Share Index daily stock price data was obtained from the FTSE Russell data streams. This data is publicly available at the FTSE Russell data streams.

6.6.2 Data population and sample

Daily closing stock prices of market indices were collected from the Nairobi Securities Exchange (NSE). The Bourse has a total of seven indices: NSE 20 Share index, NSE 25 Share Index, FTSE NSE Kenya 15 Share Index, and FTSE NSE Kenya 25 Share Index, NSE All-Share Price Index (ASPI), FTSE NSE Kenya Government Bond and the FTSE ASEA Pan African index. The population data comprises the seven indices of the NSE.

Sample data, which is time series data, was collected from five of the Bourse indices. These indices are NSE 20 Share index, NSE 25 Share Index, FTSE NSE Kenya 15 Share Index, and FTSE NSE Kenya 25 Share Index, and the NSE All-Share Price Index (NASI). Data from two of the indices was not utilised in this study. The FTSE NSE Kenya Government Bond data was not used, because it represents the Kenyan Government bond, and thus it is limited in terms of market representation. Data from the FTSE

ASEA Pan African index was not utilised because, the index represents securities listed on African Securities Exchanges Association (ASEA) constructed from securities of eighteen African Nations. This study focuses on securities listed on the NSE, because the study tests market representation in the Kenyan context.

The sample period for this study was from January 2010 to December 2020. The sample data points within the period chosen and the indices chosen comprise 15,704 observations. The observations comprised daily indices prices. The NSE 20 Share index had 2, 755 observations for the period 04 January, 2010 to 31 December, 2020, the NSE 25 Share Index had 1,333 observations for the period 01 September, 2015 to 31st December 2020, the FTSE NSE Kenya 15 Share Index had 2, 765 observations for the period 04 January, 2010 to 31 December, and the FTSE NSE Kenya 25 Share Index had 2, 765 observations for the period 04 January, 2010 to 31 December, and the NSE All-Share Price Index (NASI) had 2, 756 observations for the period 04 January, 2010 to 31 December. This period has been chosen because of its statistical representation. The data was chosen because the period is long enough to enable trends, seasonality and residual components to be adequately identified and the appropriate adjustments to be made to the time series. The indices data collected did not undergo any adjustment, because it is data that was collected directly from the Bourse's data streams and this data is openly available. Neither has the data been revised; Becketti (2013) notes that time series data is often revised or adjusted beforehand by data providers. Scholars (Corbetta, 2003; Box et.al., 2016; Francis, 2008) advise that quantitative data should be statistically representative data of above thirty data points. This will allow for the appropriate generalisation of the results.

6.6.3 Data management procedure

The data was handled and stored in a manner that ensures data reliability and integrity. The data is stored using cloud storage, as well as storing the data in multiple copies and in multiple locations. The data is stored in the most current format and media to avoid problems associated with outdated file formats or storage media. To avoid bit rot due to corruption of binary code, the data was verified by a verifier before analysis.

This study assumes that the data that was collected from the Nairobi Securities Exchange (NSE) and the FTSE Russell is timely, accurate, complete and consistent. Montgomery et al. (2015) explain that when

data is accurate, it means that the particular data will yield real values. Timeliness in data refers to the data being current, while consistency of data refers to the data records closely agreeing over time in format, content, meaning and structure. Finally, completeness of data means that the data has no outliers or missing bits.

Data transformation or cleaning methods entail ways to handle problems associated with data completeness. Data cleaning was done to address problems associated with data completeness. Montgomery et al. (2015) advise that data transformation is useful mostly for stabilising variances. Before data is analysed, the data must be subjected to different kinds of checks and visualisations to aid in data transformation. Montgomery et al. (2015) further define data cleaning as, “the process of examining data to detect potential errors, missing data, outliers or unusual values, or other inconsistencies and then correcting the errors or problems that are found”. The correction for error in this study was done through business calendar creation with appropriate centre dates, and by omitting duplicate values. The data was also transformed through log differencing.

6.6.4 Nature of data

This study is a quantitative study, and it follows that the data is numerical. Numerical data is defined as data in the form of numbers. It is referred to as quantitative, showing a measure or a count. This type of data indicates how many or how much (CFA Institute, 2021; Lind et al., 2011). In addition, the CFA Institute (2021) describes numerical data as either discrete or continuous. Discrete data is numerical data that is finite in number or has a certain value resulting from counting. It also has gaps. Continuous data entails numbers that assume any numerical value in a specific range of values, for instance, price returns of a stock that measure price change over time in percentage terms.

The numerical data collected in this study entailed stock indexes data. Koop (2009) states that indices emerge as time series data; the author and explains time series data as data that is collected at specific points in time. The time series data used in this study is continuous numerical data. A time series is further defined as a set of quantitative observations arranged in chronological order (Kirchgassner et.al, 2013). Montgomery et al. (2015:2) describe time series data as, “a time oriented or chronological sequence of observations on a variable of interest”. The authors explain that the variables in a time series are collected in equally spaced time intervals for instance daily, weekly, monthly, or quarterly and the

data could be a statistic, cumulative or instantaneous. Brockwell and Davis (2016) explain a discrete time series as one in which the set T_0 of times points at which observations are made is a discrete set, meaning observations are made at fixed time intervals. On the other hand, “continuous time series are obtained when observations are made continuously over some time intervals for example when $T_0 = [0,1]$ ” (Brockwell & Davis, 2016:1). The data that was used assess weak-form Efficient Market Hypothesis for the NSE and to determine whether the current NSE stock indices are representative of the Kenyan capital markets consisted of the daily indices’ prices. These prices were used to calculate returns in percentage terms, this provided a standardized way of comparing the index values over time.

Time series data is synonymous with trends, seasonality, cycles and various random factors. These factors are explained in the subsequent paragraphs.

6.6.4.1 Trend component

Components of time series data that are captured in a time series model include trends, seasonal variations, cyclical factors and residual variations. Francis (2008) describes the trend component as the underlying long-term tendency of the data. Koop (2009) comments that trends are sustained movements of data over time. Generally, time series data shows movement in a certain direction, either upwards, downwards or flat over a long period of time, thus showing the direction that values of the series are moving (Curwin & Slater, 2008). “The trend component denotes persistent, systematic tendency for a series to either increase or decrease” (Beckett, 2013: 93). Trends may, however, change direction and magnitude, but unlike a cycle, a trend is longer lived than an upward or downward phase in a cycle. The changeability of trends is often referred to as a local trend or current trend or recent trend - for instance, a short-lived bullish or bearish trend in a stock market (Beckett, 2013:93). Montgomery et al. (2015) add that trends may be long-term or more dynamic and of relatively short period. Curwin and Slater (2008) identify three ways of spotting a trend. Firstly, a trend can be identified visually through graph representation of the trend line. Graphical presentation of the time series values was implemented in this study. This was the first step in this research thus enabling the underlying direction of the data to be identified. However, for complex analysis, this approach might not be the most appropriate. The second way of identifying trends is by means of Moving Averages (MA). This approach smooths out fluctuations in the original series by finding intervals of time that make sense, finding an average and moving forward by one step and calculating the average again. The size of interval depends on the data, for instance,

quarterly data is calculated based on four consecutive values. Thirdly, a trend line can be identified through a linear regression. In this study, the trend was recognised through graphic representation and through the Moving Average (MA) model.

6.6.4.2 Seasonal component

The seasonal component, as the word indicates, has to do with seasons. Each business has its seasonal cycle, and this is seen in time series data of an entity. According to scholars (Curwin and Slater 2008; Francis, 2008) seasonal variations are short-term cyclic fluctuations in data. These are fluctuations that take place within one complete period. Predictable activities and occurrences within society affect business, and these expected seasonal changes are absorbed into business data including time series data. Seasonal variations can be quarterly seasons over the yearly cycle, monthly seasons over a yearly cycle, and daily seasons over a weekly cycle (Curwin & Slater, 2008; Francis, 2008). It refers to the tendency of some series to change either decrease or increase in predictable ways at the same time of day, week, month (Beckett, 2013). This implies that the seasonal component is much shorter than the trend component of a time series data. Seasonal variations give an average effect on the trend caused by the season itself and are expressed as, deviations from, or percentages of the trend (Francis, 2008). Data smoothing may be applied to make clearer the seasonal variation effects on the data (Montgomery et al. 2015). In addition, seasonality can be identified through regression models or Moving Average models (Curwin and Slater, 2008).

6.6.4.3 Cyclic component

Time series data is characterised by cycles and, according to Beckett (2013), these are movements or oscillations around the mean or a trend in a time series. Cyclical component or factor are defined as longer term regular fluctuations that take several years to complete, and are rarely of the same duration (Curwin & Slater 2008; Francis 2008). In addition, Beckett (2013) propounds that these cycles are aperiodic, but the duration and timing of the deeps and the rise (excursions) above or below the trend or mean are irregular and they affect the data at hand.

6.6.4.4 Residual variations or the random factor

The residual variation component is described as those factors that are neither trend nor seasonal variations. These are unpredictable factors and are particularly long-term. They mostly occur due to underlying economic causes such as trade cycles or minor recessions. These factors mostly have a small

effect, but sometimes their overall effect can have a significant and random bearing on data, hence their importance (Curwin and Slater, 2008).

The components discussed above are characteristics of a time series that are incorporated into time series models. The most basic of the models that describes a time series model is the random component, which is discussed in the next subsection. Francis (2008: 215) explains that these components break down a series into understandable and explainable portions.

6.7 Data analysis

Time series analysis is conducted in the present study. The objectives of time series analysis according to Brockwell and Davis (2016), are to provide a compact description of the data, predict the future values of a series, or to test hypotheses or conduct simulation studies. The time series analysis in this study focuses on testing the EMH and determining the market representativeness of the indices of the NSE. Koop (2009) states that a stock index measures changes of stock prices overtime, exclusive of dividends. This simplifies the process of interpreting data and returns made from buying the basket of shares that make up the index. This study utilises stock indices of the NSE and the FTSE Russel to analyse changes in stock returns in order to establish whether or not a relationship exists between returns of different time periods.

To achieve the first objective, which is to assess the weak form EMH for the NSE, the daily closing returns of the NSE 20 Share index, the FTSE Kenya 15 Share Index, the FTSE 25 Share Index, the NSE 25 Share Index and the NSE All-Share Price Index (NASI) were analysed using statistical tests. The analysis was conducted with a view to determine the predictability of returns by assessing whether or not the returns are independent. That entailed finding out whether the daily returns influence each other or not.

To determine whether the NSE stock indices are market representative for the Kenyan capital markets daily closing price data from NSE 20 Share index, FTSE NSE Kenya 15 Share Index, FTSE NSE Kenya 25 Share Index and the NSE 25 Share Index were analysed using the pairwise Granger Causality Test in comparison with the market performance as measured by the NSE All-Share Price Index (NASI). This

enabled an assessment as to whether a measure dependency can be observed between the indices and the NASI.

Literature referred to in the previous chapter reveals that when markets are efficient, short-term movements and market returns do not display any pattern. As a result, when modelling techniques fail to find a pattern in the market returns, this implies that the returns follow a random walk. Several techniques have been used in the literature to find patterns in time series data. Approaches like regression or exponential smoothing presume that returns are independent from one period of time to the next. Additionally, numerous statistical tests designed to test the random walk hypothesis have been presented in the literature (see Table 5.1 for some of the studies on efficient market hypothesis).

In this study, a number of time series techniques are used to identify the random patterns in the data. These are: the serial correlation test, three different linear unit root tests (the Augmented Dickey-Fuller (ADF) (1979) test, the Phillips-Perron (PP) (1988) test and the Zivot Andrews test (1992), Runs test (Bradley, 1968), the Variance Ratio test and the nonlinear Threshold Autoregressive (TAR) test.

These test methodologies are designated to examine the random walk hypothesis and hence the market efficiency in the weak form in five indices from the Kenyan Stock Exchange. The rationale behind selecting the above test methodologies includes: firstly, the weak form efficiency states that there is no correlation of price trends over time, so this can be examined statistically by using an autocorrelation test such as the Ljung and Box (1978) test. Secondly, the weak form efficiency states that the return series has to be non-stationary, and this can be tested using various linear unit root tests. Thirdly, the efficient market hypothesis could not be tested by looking at the autocorrelation when markets have infrequent trading like in some emerging markets, and thus the Run Test of randomness can be used as an alternative. Fourthly, the weak form efficiency hypothesis states that stock prices follow a random walk, and therefore the Variance Ratio test can be used. Time series data can follow a non-linear data generating process, justifying the use of nonlinear unit root tests – and thus the Threshold Autoregressive (TAR) can be used.

Time series modelling is at the centre of tests used to establish the efficient market hypothesis. For a deeper understanding of the tests utilised, this section expounds aspects of time series which include white noise that in the error term, simple time series linear model, the Autoregressive (AR) model and Moving Average (MA) models. These lead to a discussion of Autoregressive Moving Average (ARMA) models. Stationarity, autocorrelation and unit root tests are also discussed. The discussions are based mainly on ideas propounded by Tsay (2010), Brockwell and Davis (2016), Becketti (2013), Pesaran (2015), Montgomery et al. (2015), Kirchgassner and Wolters (2007)

6.7.1 White noise

According to Brockwell and Davis (2016), if $\{X_t\}$ is independent identically distributed (IID) noise, that is a sequence of uncorrelated random variables with a mean of zero and variance σ^2 , then $\{X_t\}$ is stationary with the same covariance function as the iid, this kind of sequence is known as “White noise” with a mean of zero and variance σ^2 . Indicated by the notation $\{X_t\} \sim WN(0, \sigma^2)$.

Tsay (2010:36) notes about a white noise that, “a time series r_t is called a white noise if $\{r_t\}$ is a sequence of independent and identically distributed random variables with finite mean and variance. If r_t is normally distributed with mean zero and variance σ^2 , the series is called a Gaussian white noise. For a white noise series, all the ACFs are zero. In practice, if all sample ACFs are close to zero, then the series is a white noise series”. Complicated time series models include the white noise component as the error term.

6.7.1.1 The random walk

The random walk, $\{S_t, t = 0, 1, 2, \dots\}$ (starting at zero) is obtained by cumulatively summing (or “integrating”) iid random variables. Thus, a random walk with zero mean is obtained by defining $S_0 = 0$ and $S_t = X_1 + X_2 + \dots + X_t$, for $t = 1, 2, \dots$, where $\{X_t\}$ is iid noise

If $\{S_t\}$ is the random walk defined above with $\{X_t\}$ then
 $ES_t = 0, E(S_t^2) = t\sigma^2 < \infty$ for all t , and, for $h \geq 0$,

$$\gamma_S(t+h, t) = Cov(S_{t+h}, S_t)$$

$$\begin{aligned}
&= \text{Cov}(S_t + X_{t+1} + \dots + X_t + h, S_t) \\
&= \text{Cov}(S_t, S_t) \\
&= t\sigma^2.
\end{aligned}$$

Since $\gamma_s(t + h, t)$ depends on t , the series $\{S_t\}$ is not stationary.

6.7.2 Linear time series models

Brockwell and Davis (2016) state that linear time series models provide a general framework for studying stationary processes. Second-order stationary processes are either a linear processes or can be transformed to a linear process by subtracting a deterministic component. A linear time series model is also defined as an econometric and statistical model used to describe the pattern of the ψ weights of r_t . A time series is said to be linear if it can be written as:

$$r_t = \mu + \sum_{i=0}^{\infty} \psi_i a_{t-i}, \tag{2}$$

where μ is the mean of r_t , $\psi_0 = 1$, and $\{a_t\}$ is a sequence of iid random variables with mean zero and a well-defined distribution that is $\{a_t\}$ is a white noise series. $\{a_t\}$ denotes the new information at time t of the time series and is often referred to as the innovation or shock at time t .

In the above linear model, the dynamic structure of r_t is governed by the coefficients ψ_i , which are called the ψ weights of r_t in the time series literature. According to Tsay (2010: 36), “if r_t is weakly stationary, we can obtain its mean and variance easily by using the independence of $\{a_t\}$ as;”

$$E(r_t) = \mu, \text{Var}(r_t) = \sigma_a^2 \sum_{i=0}^{\infty} \psi_i^2, \tag{3}$$

where σ_a^2 is the variance of $\{a_t\}$, because $\text{Var}(r_t) < \infty$, $\{\psi_i^2\}$ must be a convergent sequence, that is, $\psi_i^2 \rightarrow 0$ as $i \rightarrow \infty$. Consequently, for a stationary series, impact of the remote shock a_{t-i} on the return r_t vanishes as i increases. Based on this model, the auto covariance and auto correlation function can be modelled.

6.7.3 Autoregressive (AR) model

A simple AR model is written as:

$$r_t = \varphi_0 + \varphi_1 r_{t-1} + a_t, \quad 4$$

where $\{a_t\}$ is assumed to be a white noise series with mean zero and variance. This is the simplest AR model and it is known as the AR (1) model. The model is utilised for stochastic volatility modelling. An AR (2), on the other hand, assumes the form:

$$r_t = \varphi_0 + \varphi_1 r_{t-1} + \varphi_2 r_{t-2} + a_t. \quad 5$$

The AR(1) and AR(2) model can be generalised to the AR(p) model. The AR(p) model is commonly used in time series modelling. An autoregressive (AR) model can be used for prediction. These models are similar to the simple linear regression model where there is a dependent variable and an explanatory variable. Aspects of this model are utilised in this study. The order (p) of a given time series is unknown, and is determined through partial autocorrelation function (PACF) which is a function of ACF and through the use of particular information criteria. This study utilises information criteria to determine order (p). There are many information criteria; all of them are based on the Likelihood function. Some of the most common Akaike information criteria (AIC) by Akaike (1973) and Schwarz–Bayesian information criterion (BIC).

AIC is defined as:

$$AIC = \frac{-2}{T} \ln(\text{likelihood}) + \frac{2}{T} \times (\text{number of parameters}), \quad 6$$

where the likelihood function is evaluated at the maximum-likelihood estimates and T is the sample size.

The Gaussian AR(l) model AIC reduces to:

$$AIC(l) = \ln(\sigma_l^2) + \frac{2l}{T}, \quad 7$$

where σ_l^2 is the maximum-likelihood estimate of σ_a^2 , which is the variance of a_t , and T is the sample size. The first term of the AIC measures the goodness of fit of the AR(l) model to the data, while the second term is called the penalty function of the criterion because it penalises a candidate model by the number of parameters used. Different penalty functions result in different information criteria. The

Schwarz-Bayesian information criterion (BIC) is another information criterion. For a Gaussian $AR(l)$ model, the criterion is:

$$BIC(l) = \ln(\sigma_i^2) + \frac{\ln(T)}{T}. \quad 8$$

The penalty for each parameter used is 2 for AIC and $\ln(T)$ for BIC. Therefore, BIC tends to select a lower AR model when the sample size is moderate or large.

The selection criteria for AIC and BIC, according to Tsay (2010), are that computation of $AR(l)$ for $AIC(l)$ for $p = 0, \dots, P$, where p is a pre specified positive integer and selects the order k that has the minimum AIC value and the same criterion applies for BIC. It is, however, important to note that neither of the information criteria is better than the other.

6.7.4 Moving Average (MA) Model

Consider the AR model with infinite order as; $r_t = \varphi_0 + \varphi_1 r_{t-1} + \varphi_2 r_{t-2} + \dots + a_t$,

to make the model practical with finite number of orders is to assume that the coefficient φ_i 's satisfies some constraints:

$$r_t = \varphi_0 - \theta_1 r_{t-1} - \theta_1^2 r_{t-2} - \theta_1^3 r_{t-3} - \dots + a_t, \quad 9$$

where the coefficients depend on a single parameter θ_1 via $\varphi_i = -\theta_1^i$ for $i \geq 1$. For the model to be stationary, θ_1 must be less than 1 in absolute value; otherwise, θ_1^i and the series will explode. Because $|\theta_1| < 1$, we have $\theta_1^i \rightarrow 0$ as $i \rightarrow \infty$. Thus, the contribution of r_{t-i} to r_t decays exponentially as i increases. This is reasonable as the dependence of a stationary series r_t on its lagged value r_{t-i} if any, should decay over time.

The model can be rewritten as:

$$r_t + \theta_1 r_{t-1} + \theta_1^2 r_{t-2} + \dots = \varphi_0 + a_t. \quad 10$$

The model for this r_{t-i} is then written as:

$$r_{t-1} + \theta_1 r_{t-2} + \theta_1^2 r_{t-3} + \dots = \varphi_0 + a_{t-1}. \quad 11$$

From the above two equations we can obtain the below equation:

$$r_t = \varphi_0(1 - \theta_1) + a_t - \theta_1 a_{t-1}, \quad 12$$

where r_t is a weighted average of shocks a_t and a_{t-i} , hence the model is an MA model of order 1 or an MA(1). General model of MA (1) is:

$$r_t = c_0 + a_t - \theta_1 a_{t-1} \text{ or } r_t = c_0 + (1 - \theta_1 B)a_t, \quad 13$$

where the c_0 is a constant and a_t is a white noise on the other hand an MA(2) is written as;

$$r_t = c_0 + a_t - \theta_1 a_{t-1} - \theta_2 a_{t-2}, \quad 14$$

while an MA(q) is:

$$r_t = c_0 + a_t - \theta_1 a_{t-1} - \dots - \theta_q a_{t-q}, \quad 15$$

or

$$r_t = c_0 + (1 - \theta_1 B - \dots - \theta_q B^q) a_t, \text{ where } q > 0. \quad 16$$

Based on this model, the auto covariance and auto correlation function can be modelled together with other time series models. The ACF is useful in identifying the order of an MA model. For a time series r_t with $ACF_{\rho q}$, if $\rho_q \neq 0$, but $\rho_l = 0$ $l > q$, then r_t follows an MA(q) model. MA models are estimated by maximum-likelihood functions. There are two approaches to the estimation process, namely the conditional-likelihood method exact-likelihood method.

Moving Average (MA) are used in modelling times series returns in finance. It is used to check for trend in time series model and this form is synonymous with the autocorrelation function. Tsay (2010:59) notes that, "Moving-average models are always weakly stationary because they are finite linear combinations of a white noise sequence for which the first two moments are time invariant". MA models are introduced in different ways one of the ways is through treating the model as an extension of white noise series and another way is to treat the model as an infinite – order AR model some parameter constraint (Tsay, 2010).

6.7.5 Autoregressive Moving Average (ARMA)

In this study, Autoregressive Moving Average (ARMA) models are used. This is because higher order models with higher parameters are required for time series analysis. ARMA models are a combination of the AR and MA into a compact form so that fewer parameters are utilised, thus realising parsimony

in parameterisation or a more parsimonious model (Montgomery et al., 2015; Tsay, 2010). A time series model for example follows an ARMA model if it satisfies:

$$\{a_t\} r_t - \varphi_1 r_{t-1} = \varphi_0 + a_t - \theta_1 a_{t-1}, \quad 17$$

Where $\{a_t\}$ is a white noise series. The constant term is φ_0 while the $\varphi_1 \neq \theta_1$ to avoid cancellation. According to Tsay (2010:66), “the stationarity condition of an ARMA (1,1) model is the same as that of an AR (1) model, and the ACF of an ARMA (1,1) exhibits a similar pattern like that of an AR (1) model except that the pattern starts at lag 2”. The PACF of an ARMA model does not cut off at any finite lag, it behaves like an MA (1) model. MA and AR models are special cases of ARMA (p,q) models. ARMA models are defined by linear difference equations with constant coefficients Brockwell and Davis (2016).

A general ARMA model is given as:

$$r_t = \varphi_0 + \sum_{i=1}^p \varphi_i r_{t-i} + a_t - \sum_{i=1}^q \theta_i a_{t-i}, \quad 18$$

where $\{a_t\}$ - white noise p and q - non-negative integers.

6.7.6 Stationarity and Unit root tests

At this point, it is important to elaborate on the concept of stationarity in time series data. Stationarity is the most important and common assumption in time series analysis. The basic concept of stationarity is that the probability laws governing data do not change over time. It is the simplifying assumption in time series that enables identification of joint distribution (Kirchgassner et al., 2013). In this study, stationarity will be tested by testing for the presence of unit roots in the data using statistical models. Montgomery et al. (2015:328) explain that, “the stationarity of a time series is related to its statistical properties in time. Meaning that a stationary time series exhibits similar “statistical behaviour” in time. This is often characterised as a constant probability distribution in time”.

In other words, a time series can be mean stationary, variance stationary, covariance stationary. This means that for time series data to be stationary, it must have a constant mean, a constant variance and no seasonality. Further explanations from Montgomery et al. (2015:33) indicate that, “a time series is said to be strictly stationary if its properties are not affected by a change in the time origin. That is, if the joint

probability distribution of the observations $y_t, y_{t+1}, \dots, y_{t+n}$ is exactly the same as the joint probability distribution of the observations $y_t, y_{t+k+1}, \dots, y_{t+k+n}$ then the time series is strictly stationary.”

Brockwell and Davis (2016:43) mention the properties of a strict stationary time series $\{X_t\}$ as, (i) “the random variables X_t are identically distributed, $(X_t, X_{t+h})' d = (X_1, X_{1+h})$ for all integers (ii) t and h , $\{X_t\}$ is weakly stationary if $E(X_t^2) < \infty$ for all t , (iii) weak stationarity does not imply strict stationarity, an iid sequence is strictly stationary. Strict stationarity is not applied in practice (Kirchgassner et al., 2013). The authors define stationarity (or weak stationarity) as the expected value of the time series that does not depend on time and the auto covariance function defined as $Cov(y_t, y_{t+k})$ for any lag k is only a function of k and not time; that is, $\gamma_y(k) = Cov(y_t, y_{t+k})$ ”.

Tsay (2010) adds that the implication of this is that graphical representation of the data shows that T values fluctuate with constant variation around a fixed level and weak stationarity enables predictions of future returns. Tsay (2010) notes that it is common to assume financial time series to be weakly stationary; it can be disapproved or confirmed through empirical study of a large historical data of the same. Time series stationarity is required for the application of AR, MA, ARMA and ARIMA models. In other words, these models assume that the time series data that is analysed is stationary.

6.7.6.1 Unit root tests

Time series values are analysed in the framework of time series models. In other words, time series analysis entails, “the evaluation and extraction of the components of a model that break down a particular series into understandable and explainable portions” (Francis, 2008:215). The evaluation of components in a time series model allows matters such as trends, seasonal factors, cyclical factors, and random factors to be identified and irrelevant factors be removed. There are various types of models used for the purposes of time series analysis amongst them additive and multiplicative models (Francis, 2008:215).

Unit root tests are used to examine the randomness of return series by investigating the presence of a unit root which is also known as non-stationarity of a time series data: “Nonstationary behaviour of time series is covered by ARIMA(p,d,q) models” (Kirchgassner & Wolters, 2007:164). Kirchgassner and

Wolters (2007) add that unit root tests provide for formal testing of time series and provide a way to distinguish for covariance stationarity or trend stationarity and difference stationary behaviour in time series. According to the authors, these tests were developed by Wayne A. Fuller (1976) and by David A. Dickey and Wayne A. Fuller (1979).

Pesaran (2015:326) posits that a unit root process is a generalisation of the random walk model, where the innovations, u_t , in the random walk model

$$y_t = y_{t-1} + u_t, \tag{19}$$

are allowed to follow a general linear stationary process

$$u_t = \sum_{i=0}^{\infty} a_i \varepsilon_{t-i}, \tag{20}$$

where $\{\varepsilon_t\}$ is mean zero, serially uncorrelated process. Therefore, $\{y_t\}$ is an integrated process of order 1, I(1). Similarly, $\{u_t\}$ is also referred to as an I(0) process. The I(1) process in (40) is a unit root process without a drift, namely $E(y_t) = y_0$. A unit root process with a non-zero drift is defined by

$$\Delta y_t = \mu + u_t, \tag{21}$$

where $\mu \neq 0$, is the drift parameter of the process. Under (42), y_t is still an I(1) process, but with a drift. The level of the process, y_t , has a trend and $E(y_t) = y_0 + \mu t$, for $t = 0, 1, 2, \dots$.

This study employs both linear and nonlinear unit root tests. The linear unit root tests implemented are the conventional Augmented Dickey – Fuller (ADF) test advanced by David A. Dickey and Wayne A. Fuller (1979, 1981), the Phillips –Peron (PP) unit root test advanced by Phillips and Perron (1987), and the Zivot Andrews test advanced by Zivot Andrews (1992). The nonlinear unit root tests used applied for the data analysis include the threshold autoregressive unit root test advanced by Enders and Granger (1998) and Bec et al. (2004).

6.7.6.3 Serial correlation

Serial dependency tests are among the first tests to examine and ascertain the stationarity of time series data. Serial (auto) correlation refers to the correlation of random variable with past or future values. It

focuses on the possibility that the error term is correlated, thus rejecting the classical assumption that errors are uncorrelated (Beckett, 2013).

The ACF and the PACF which are derived from the auto covariance function (ACVF), are used to check the auto correlation of a series. Montgomery et al. (2015) advise using both models in analysis because they have distinct and indicative properties for MA and AR models.

The sample autocorrelation function (ACF) of r_t is important in time series, because a linear time series model can be characterised by its ACF, and linear time series modelling makes use of the sample ACF to capture the linear dynamic of the data (Tsay, 2010). This study applied the ACF, PACF functions and the Q-test to check for serial correlation. The ACF, PACF and Q-test are further discussed in terms of model specification.

6.8 Preliminary data analysis

Preliminary data analysis of the time series data enabled the researcher to understand the characteristics of the data that was analysed. It provided an understanding of the nature of its variation in both long term and short term and its trends. Montgomery et al. (2015) advise that for a better ‘feel’ and understanding of the data, computation and evaluation of numerical summaries of the data such as sample mean, standard deviation, percentile and autocorrelation in preliminary analysis of the time series data are necessary. The present study computed descriptive statistics and graphical plots at the preliminary analysis stage towards a better understanding of the data. Visualisation of data through the construction of time series graphical plots was done in the preliminary stage. These plots were scrutinised for recognition of unusual data points and outliers, components such as trend patterns, cyclical factors and seasonal variations were also recognised (Montgomery et al., 2015; Brockwell & Davis, 2016).

6.8.1 Data organization for quantitative analysis

Organisation of data for quantitative analysis in this study was done in a one-dimensional array. This kind of arrangement applies to time series, and it consisted of daily index prices that can be organised in two columns in a sequential manner. The CFA institute (2021) mentions a one-dimension array to be one of the simplest formats for representing data. It is suitable for time series data, because time series data is one variable data arranged in a time-ordered sequence. In this case, the closing index prices were collected at daily intervals and thus the data is in a time ordered sequence. All indices’ data was presented in a one-dimensional array from which log differences were computed.

6.8.2 Log transformation

Time series data in its raw form is non-stationary, and therefore the data requires transformation to stationary data to enable application of ARMA models. Becketti (2013) comments that transforming data before analysis is important, because it helps to stabilise the variance of time series data before analysis. The author adds that one of the ways to transform data is through the power family transformation given by:

$$y^{(\lambda)} = \begin{cases} \frac{y^\lambda - 1}{\lambda - 1}, \lambda \neq 0. \\ \lambda y \\ y \ln y, \lambda = 0 \end{cases} \quad 22$$

This is known as log transformation. It is used when variability of time series in its original form increases with average level of the series. It is commonly referred to as percentage change (Becketti, 2013).

6.8.3 Calculating returns of the series

The first step in the time series data analysis was to calculate the market returns from the daily index prices of the market indices by using natural logarithms. To achieve this, the researcher followed Koop (2009) and Ananzeh (2014), “If Y_t ($t=1, \dots, T$) is a time series variable, then $\Delta Y_t = Y_t - Y_{t-1}$ is the first difference of Y_t^2 . ΔY_t Measure the change in a variable over time $100x [\ln(Y_t) - \ln(Y_{t-1})]$ ” (Koop, 2009:139). The natural logarithm of Y_t and ΔY_t would measure the change in percentage in the original variable between time $t-1$ (lagged one period) and t , where a lag is simply a time period (Koop, 2009; Tsay, 2010). This means that the percentage change represents the index returns between periods. The real rate of return was thus calculated by using the first log difference for daily price index for the selected indices to establish returns of the period (Ananzeh, 2014; Koop, 2009).

$$R_t = [\ln(p_t) - \ln(p_{t-1})],$$

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right). \quad 23$$

Where:

R_t = Return of price index

p_t = Price at time t

p_{t-1} =Price at time $t-1$

Price returns R_t are expressed in % terms:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \times 100. \quad 24$$

6.8.4 Graphical presentation of the indices data

According to the CFA Institute (2021), arranging the data in a one-dimension array enables valuable information like trends and patterns to be preserved and can be easily presented through line graphs. Line graphs were plotted for all the indices prices and returns. Both daily closing prices and daily returns of the indices were illustrated by aid of line graphs. The graphs were used to understand the data more and analyse the trend, pattern, stationarity and non-stationarity of the indices data. According to the CFA Institute (2021), a line chart is a graph that visualises ordered observations. It usually illustrates the change of data series over time, and the graphs indicate comparisons over time.

In addition, due to the numerical nature of the data, histograms and Q-Q plots were also used to indicate distribution of both the daily prices of the indices and the returns. A histogram is a chart that presents the distribution of numerical data by using the height of a bar or column to represent the absolute frequency of each bin or interval in the distribution (CFA Institute, 2021).

6.8.5 Descriptive statistics

For ease of understanding and to provide information about the data, descriptive statistics was also obtained. Measures of central distribution and measures of variability were presented, including the sample mean, the median, the standard deviation, the minimum and the maximum values, skewness and kurtosis were computed and presented. The CFA Institute (2021) describes measures of central tendency as those that specify where data is centred. The mean and the median for all the five indices percentage returns were computed and presented in the results section. The sample mean or the arithmetic mean that was presented were the values of the observations divided by the number of observations, while the median is the value of the middle item sorted in ascending or descending order (CFA Institute, 2021).

The measure of standard deviation was also given for all indices. Standard deviation is a measure of deviation from the mean, and it is the square root of variance. The CFA Institute (2021) states that

measures of dispersion are variations around the central tendency. These measures include range variance, standard deviation, dispersion and mean absolute deviation. These measures are also known as absolute dispersion measures, which entails the amount of variability present without comparison to any particular point. Also, variance and standard deviation are used as a measure of risk as shown by Harry Markowitz.

6.8.6 Tests of normality

The characteristics of the returns distributions is important in this study, because it gives an understanding of the daily returns of the indices. The CFA Institute (2021) explains that the normal distribution is one of the most important distributions and some statistical models used in the analysis of the returns assume normality. The normal distribution is defined by two parameters: the mean μ , and variance, σ^2 . It is then defined as $X \sim N(\mu, \sigma^2)$: “X follows a normal distribution with mean μ and variance σ^2 ” (CFA Institute, 2021). Other forms of distributions, including skewed distributions, are described by more than the two parameters. This section peruses distributions that were expected together with their implications, and tests of normality are also discussed in this section. The following sub-sections provide brief explanations of the tests used to test for normality in this study.

6.8.6.1 Jarque – Bera test

Jarque- Bera test was used to test the normal distribution of the series. Scholars (Abedini, 2006; Laurel, 2016) define the test as:

$$JB = \frac{n-k+1}{6} \left(S^2 + \frac{1}{4}(C-3) \right)^2, \quad 25$$

where S is the sample skewness and C is the kurtosis and n denotes number of observations. According to Abedini (2009), if the p-value < 0.05 , at the 5% significance level then the null hypothesis of normality is rejected.

To examine normality of the daily returns of the indices, the following hypotheses were tested:

H_0 : daily returns of the NSE 20, NSE 25, FTSE NSE 15, FTSE NSE 25 and NASI daily stock returns are normally distributed.

Vs

H_a : daily returns of the NSE 20, NSE 25, FTSE NSE 15, FTSE NSE 25 and NASI daily stock returns are not normally distributed.

6.8.6.2 Shapiro Wilks' test

Singh (2007) notes that the Shapiro Wilks' W was developed by Shapiro and Wilk (1965). It is the correlation between a data and their normal score. The test can be used in both large and small data samples. The W test is given by:

$$w = (\sum a_i x_i)^2 / (\sum x_i - \bar{x})^2, \quad 26$$

where $x_{(i)}$ is the i-th largest order statistic, \bar{x} is the sample mean. The coefficients $a_i, i = 1, \dots, n$ is computed using the approximation by Royston (1982) to obtain the significance level of the w statistic (Singh, 2007 & Laurel, 2016). Where the p-value for the test is smaller than alpha 0.05, one rejects the null hypothesis.

To examine the normality of the daily returns of the indices, the following hypotheses were tested:

H_o : daily returns of the NSE 20, NSE 25, FTSE NSE 15, FTSE NSE 25 and NASI daily stock returns are normally distributed.

Vs

H_a : daily returns of the NSE 20, NSE 25, FTSE NSE 15, FTSE NSE 25 and NASI daily stock returns are not normally distributed.

6.8.7 Skewness and kurtosis

Skewness can be defined as the amount and extent that a distribution deviates from symmetry. It describes how lopsided the data is, either being positively or negatively distributed (Francis, 2008). Skewness is defined with respect to the third moment about the mean. The CFA Institute (2021:138) explains skewness as,

“the name given to a statistical measure of skew and is computed as the average cubed deviation from the mean standardized by dividing by the standard deviation cubed to make the measure

free of scale. A symmetric distribution has skewness of 0, a positively skewed distribution has positive skewness, and a negatively skewed distribution has negative skewness”.

This means that a positive skew, for instance, would have more positive deviations than the average magnitude of negative deviations. Also, a positive skew has frequent small losses and a few extreme gains. In a continuous positively skewed distribution, the mode is less than the median, which is less than the mean. On the other hand, with continuous negatively skewed distribution, the mean is less than the median, which is less than the mode. The approximation for computing sample skewness when n is large is:

$$\left(\frac{1}{n}\right) \frac{\sum_{i=1}^n (x - \bar{x})^3}{s^3}. \quad 27$$

Skewness values not equal to zero indicate non-normality of the data and skewness of zero indicate normality (symmetry) of the data.

Kurtosis

Kurtosis is another way of testing whether a distribution is deviating from a normal distribution. Large deviations from the mean are another way of checking for deviations from normality. Kurtosis was used as an additional examination for symmetry of the series. Kurtosis was also used as an additional examination for symmetry of the series. Skewness refers to the symmetrical nature of distribution, whereas kurtosis refers to the peakedness of the curve (Singh, 2007). The sample excess (K_E) for a large sample size (n = 100 or more) is approximately (CFA Institute, (2021):

$$K_E = \left[\left(\frac{1}{n}\right) \frac{\sum_{i=1}^n (x - \bar{x})^4}{s^4} \right] - 3. \quad 28$$

In addition, “the calculation for kurtosis involves finding the average of deviations from the mean raised to the fourth power and then standardizing that average by dividing by the standard deviation raised to the fourth power. A normal distribution has kurtosis of 3.0, so a fat-tailed distribution has a kurtosis of above 3 and a thin-tailed below 3.0” (CFA Institute (2021: 140). Excess kurtosis is the kurtosis relative to the normal distribution.

Kurtosis is also referred to as the weight of the tails of a distribution relative to the rest of the distribution, for instance the proportion of the total probability that is outside 2.5 standard deviations of the mean (CFA Institute, 2021). The Institute further informs that leptokurtic or fat tailed refers to a distribution that has fatter tails than the normal distribution; a platykurtic or thin-tailed refers to a distribution that has thinner tails than the normal distribution, and a distribution similar to the normal distribution as concerns relative weight in the tails is called mesokurtic. A fat-tailed distribution tends to generate more-frequent extremely large deviations from the mean than the normal distribution and a thin-tailed distribution would generate less frequent extremely large deviations from the mean than the normal distribution (CFA Institute, 2021).

6.9 Model specification for assessing the weak-form Efficient Market Hypothesis (EMH) for the Nairobi Securities Exchange (NSE)

The purpose of this objective is to assess the NSE 20 Share index, the FTSE Kenya 15 Share Index, the FTSE 25 Share Index, the NASI and the NSE 25 Share Index daily returns. The returns are analysed to determine the predictability of the returns by assessing the dependency between the changes in returns.

In this study, the following time series techniques have been used to identify the random patterns in the data: the serial correlation test, the Variance Ratio (1988) test, three different linear unit root tests (the Augmented Dickey-Fuller (ADF) (1979) test, the Phillips-Perron (PP) (1988) test and the Zivot Andrews (1992) test, Run test (Bradley, 1968), and the nonlinear threshold autoregressive (TAR) test. The tests will be explained in the following sub-sections.

6.9.1 Serial (auto) correlation and the Ljung Box test

The serial correlation test is a parametric test which determines the correlation between dependent variable x_t and its lagged variable x_{t-1} . Kevin (2009) explains that this is a parametric test. Randomness of index price changes can be tested by the analysis of correlation between price changes of one period and price changes of the same index in another period. The presence of autocorrelation of zero indicates the absence of correlation between price changes, and thus having long memory, stationarity in time series indicates absence of long memory (Koop, 2009).

Serial correlation has the following properties (see CFA Institute (2021)):

- Correlation ranges are between -1 and $+1$ for two random variables, X and Y : $-1 \leq r_{XY} \leq +1$
- A correlation of 0 indicates an absence of any linear relationship between the variables. A positive correlation close to $+1$ indicates a strong positive linear relationship.
- A correlation of 1 indicates a perfect linear relationship. A negative correlation close to -1 indicates a strong negative linear relationship.
- Where the relationship is found to be either positive or negative it can be concluded that the data does not behave in a random way and therefore the indices are not weak form efficient (Tsay 2010; Katabi & Raphael, 2018). This means that where correlation coefficient is positive or negative then the stock returns have a positive linear relationship an indication that the of non-random behaviour.
- In the case where the correlation is zero, there is no linear relationship present an indication of random behaviour.

This study implemented the serial correlation tests as discussed by Tsay (2010). The author explains the concept of correlation is generalised to autocorrelation when checking the linear dependence between r_t and r_{t-1} . The correlation coefficient at lag l for r_t and r_{t-1} is given by ρ_l and under the weak stationarity is a function of l only.

$$\rho_l = \frac{Cov(r_t, r_{t-l})}{\sqrt{Var(r_t)Var(r_{t-l})}} = \frac{Cov(r_t, r_{t-l})}{Var(r_t)} = \frac{\gamma_l}{\gamma_0}. \quad 29$$

The property for $Var(r_t) = Var(r_{t-1})$ for stationary series is used, and

$\rho_0 = 1$, $\rho_l = \rho^{-l}$, and $-1 \leq \rho_l \leq 1$. A weakly stationary series is not correlated if $\rho_l = 0$, for all $l > 0$.

For a sample of returns $\{r_t\}_{t=1}^T$ then the sample mean \bar{r} , then lag 1 sample autocorrelation of r_t is

$$\rho_1 = \frac{\sum_{t=2}^T (r_t - \bar{r})(r_{t-1} - \bar{r})}{\sum_{t=1}^T (r_t - \bar{r})^2}, \quad 30$$

where, p_l is a consistent estimate of p_l .

the lag l sample (ACF) of r_t is defined as

$$\rho_l = \frac{\sum_{t=l+1}^T (r_t - \bar{r})(r_{t-l} - \bar{r})}{\sum_{t=1}^T (r_t - \bar{r})^2}, 0 \leq l < T-1, \quad 31$$

where the sample PACF $p(l)$ is given by

$$p(0) = 1, \quad 32$$

$$p(l) = \varphi_{ll}, l \geq 1. \quad 33$$

This will be used to test the null hypothesis $H_0 : P_l = 0$ and the alternative hypothesis $H_a : p_l \neq 0$ and

the test statistic is the t ratio which is $t \text{ ratio} = \frac{\rho_l}{\sqrt{(1 + 2 \sum_{i=1}^{l-1} p_i^2) / T}}$. The test follows asymptotically

the standard normal distribution. The null hypothesis H_0 is rejected if the t ratio is large or, the p value of the t ratio is small, that is it is less than 0.05.

Several autocorrelations of r_t were required to be tested in this study. Because of this, the Portmanteau test (Q test) was applied. This test was first proposed by Box and Pierce (1970) it is written as

$$Q^*(m) = T \sum_{l=1}^m p_l^2. \quad 34$$

Ljung and Box (1978) modified the $Q^*(m)$ statistic to increase the power of the test in finite samples, written as

$$Q(m) = T (T + 2) \sum_{l=1}^m \frac{p_l^2}{T-l}. \quad 35$$

The decision rule is to reject H_0 if $Q(m) > \chi_{\alpha}^2$, where χ_{α}^2 denotes the $100(1 - \alpha)$ th percentile of a chi-squared distribution with m degrees of freedom. The decision rule is to reject H_0 if the p value is

less than or equal to α , (the significance level 0.05). Presence of auto correlation indicates dependency in returns.

The following hypothesis are tested:

$H_0 : P_l = 0$ (There is an absence of serial correlation between price changes over successive q-time lags hence non dependency in returns).

Vs.

$H_a : p_l \neq 0$ (There is positive or negative serial correlation between price changes over successive q-time lags hence dependency in returns).

6.9.2 Unit root tests

Random walk requires the time series to contain a unit root. Therefore, the thesis starts by testing for the presence of a unit root in the indices series. Three different unit root tests are employed to examine the null hypothesis of a unit root. These are the Augmented Dickey-Fuller (ADF) tests (1979), the Phillips-Perron (PP) test and Zivot Andrews (1992) test.

6.9.2.1 Augmented Dickey Fuller (ADF) test

An ADF test is an ARIMA test: “The ADF approach controls for higher order correlation by adding lagged difference terms of the dependent variable Y to the right-hand side of the regression” (Agung, 2009:446). According to Tsay (2010), ARIMA (p,d,q) models are more appropriate for time series models than the simple model ARMA model. AR(p) models are mostly used to test for unit root in an AR (p) process the hypothesis $H_0: \beta = 1$ and $H_a: \beta < 1$ and is tested using the regression:

$$x_t = c_t + \beta x_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta x_{t-i} + e_t, \quad 36$$

where, c_t is a deterministic function of the time index t and $\Delta x_j = x_j - x_{j-1}$ and is the differenced series of x_t . In practice, c_t can be zero or a constant or $c_t = \omega_0 + \omega_1 t$.

which is written as

$$\Delta x_t = c_t + \beta_c x_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta x_{t-i} + e_t, \quad 37$$

where $\beta_c = \beta - 1$. One can then test the equivalent hypothesis $H_0 : \beta_c = 0$ vs. $H_a : \beta_c < 0$

Pesaran (2015) adds that p is chosen such that the equation's residuals, ε_t , are serially uncorrelated and the model selection criteria like Akaike information criterion (AIC), or the Schwarz Bayesian Criterion (SBC) are used to select p .

and the t ratio of $\beta - 1$ is given by the ADF test

$$ADF - test = \frac{\beta - 1}{std(\beta)}, \quad 38$$

where β denotes the least-squares estimate of β .

According to Pesaran (2015: 334), the DF statistic is given by the t -ratio of the OLS estimate of β , namely the t -ratio of the coefficient associated with the level variable, y_{t-1} , in the regression of Δy_t on the intercept term, a linear time trend, and y_{t-1} . The critical values of DF and ADF are the same (Pesaran, 2015). In this study, the Mackinnon (1991) Tau (τ) critical values were used, and it follows that null hypothesis $H_0 : \pi = 0$ and alternate hypothesis $H_1 : \pi < 0$ since $H_0 : \beta = \pi = 0$ are tested.

This study estimates the ADF test using three different equations. Model (39) represented a pure random walk, model (40) with intercept represented random walk with drift, model (41) with trend and an intercept represented a random walk with drift around stochastic trend as stated by (Agung, 2009).

a) Pure random walk, meaning no intercept and no time trend items:

$$\Delta x_t = \beta_c x_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta x_{t-i} + e_t, \quad 39$$

b) Random walk with drift, meaning intercept and no time trend item:

$$\Delta x_t = c_t + \beta_c x_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta x_{t-i} + e_t, \quad 40$$

c) Random walk with drift around stochastic trend, meaning intercept and time trend item:

$$\Delta x_t = c_t + \beta_c x_{t-1} + c_1 t + \sum_{i=1}^{p-1} \phi_i \Delta x_{t-i} + e_t, \quad 41$$

where: Δ = represent first differences; x_t = the log of price index; c_t = the constant (drift); c_1 = estimated coefficient for the trend; t = trend term; p = number of lagged terms, where ; $c_1 t$ = a linear time trend β_c and ϕ_i = coefficients to be estimated; e_t = Error term. The first equation will test a pure random walk without constant time trend, the second walk tests pure random walk with drift, while third equation tests random walk with drift and trend.

The following null and alternate hypotheses were tested:

H_0 : Y_t does contain a unit root (the time series is non-stationary, thus a random walk)

or

H_0 : $\pi = 0$ since H_0 : $\beta = \pi = 0$

Vs.

H_a : x_t does not contain a unit root (the time series is stationary, thus not a random walk)

or

H_1 : $\pi < 0$ since

If the computed absolute value of the tau statistic $|\tau|$ exceeds the ADF or MacKinnon critical tau values, the time series is stationary. If the computed absolute value of the tau statistic does not exceed the ADF or MacKinnon critical tau values, then the time series is non-stationary and Reject null hypothesis if P-values for all lags are below alpha (0.05) (Katabi & Raphael, 2018; Ambalal, 2018).

6.9.2.2 The Phillips – Peron (PP)

This research follows Pesaran's (2015) perspectives on the Phillip Perron test. The Phillips – Peron (PP) test is an advancement of the DF t statistics with Z_t statistics. It allows for autocorrelation and conditional heteroscedasticity (Ananzeh, 2014; Herranz, 2017). Phillips and Perron (1988) advanced the non-

parametric test of the unit root test hypothesis which attempts to correct for the effect of residual serial correlation in a simple DF regression using non-parametric estimates of the long-run variance (Pesaran, 2015);

Model with intercepts but without trend

Pesaran (2015) points out that the following DF regression is utilised

$$\Delta y_t = a + by_{t-1} + u_t, t = 1, 2, \dots, T, \tag{42}$$

Denoting the residuals of this regression by \check{u}_t and the t ratio of the OLS estimator of b

by

$$s_T^2 = \frac{\sum_{t=1}^T u_t^2}{T}, y_j = \frac{\sum_{t=j+1}^T u_t u_{t-j}}{T}, \tag{43}$$

and
$$s_{LT}^2 = \gamma_0 + 2 \sum_{j=1}^m \left(1 - \frac{j}{m+1}\right) y_j. \tag{44}$$

which uses the Bartlett window³. The PP unit root test is given by (Pesaran, 2015)

$$Z_{\tau,df} = \left(\frac{s_T}{s_{LT}}\right) DF_{\tau} - \frac{1/2(s_{LT}^2 - s_T^2)}{s_{LT} \left[\frac{\sum_{t=1}^T (y_{t-1} - \bar{y} - 1)^2}{T^2} \right]^{1/2}}, \tag{45}$$

where $\bar{y} - 1 = \sum_{t=1}^{T-1} y_{t-1} / T$.

Models with an intercept and linear trend (Pesaran, 2015)

The underlying DF regression is

$$\Delta y_t = a_0 + a_1 t + by_{t-1} + u_t, t = 1, 2, \dots, T, \tag{46}$$

with DF_t given by the t ratio of the OLS estimate of y_{t-1} and

$$u_t = \Delta y_t - a_0 - a_1 t - \hat{b} y_{t-1}, \tag{47}$$

$\Delta y = W\theta + u$ where the above in matrix notation is

Then the PP statistics in this case is given by (Pesaran, 2015);

$$Z_{t,df} = \begin{pmatrix} s_T \\ s_{LT} \end{pmatrix} DF_t - \frac{T^3 (s_{LT}^2 - s_T^2)}{4 \sqrt{3s_{LT} D_w^{1/2}}}, \quad 48$$

where D_w is the determinant of the matrix $W'W$

The asymptotic critical values of $DF\tau$ and DFt applies to the PP tests (Pesaran, 2015).imilar to the ADF, this study estimates the PP test using three different equations. Model (39) represented a pure random walk, model (40) with intercept represented random walk with drift, model (41) with trend and an intercept represented a random walk with drift around stochastic trend. Where the computed absolute value of the tau statistic $|\tau|$ exceeds the ADF or MacKinnon critical tau values, the time series is stationary, (Katabi & Raphael, 2018). Where the computed absolute value of the tau statistic does not exceed the ADF or MacKinnon critical tau values, the time series is non-stationary (Katabi & Raphael, 2018; Ambalal, 2018). In addition, reject null hypothesis if P-values for all lags are below alpha (0.05) Similar null and alternate hypotheses are utilised.

The PP model tested the following hypotheses:

$H_0 : Y_t$ does contain a unit root (the time series is non-stationary, thus a random walk)

Or

$H_0 : \pi = 0$ since $H_0 : \beta = \pi = 0$

$H_a : x_t$ does not contain a unit root (the time series is stationary, thus not a random walk)

or

$H_1 : \pi < 0$ since

Limitations of the ADF and PP unit root test include their low power against alternative hypothesis of stationarity with a large autoregressive root. In addition, when the series has a large negative MA root,

there is a severe size distortion found in the ADF and PP tests, thus over rejecting the null hypothesis. This led to the employment of a number of unit root tests for verification purposes.

6.9.2.3 Zivot Andrews test

Zivot Andrews' unit root test was advanced by Zivot Andrews (1992). The test considers structural break unlike majority of the tests that ignore structural breaks. In Phillip Perron's original test, it was shown that the power to reject a unit root reduces when the alternative null is true and a structural break is ignored. Phillip and Perron (1988) further showed that the exact timing of the break is unknown (Laurel, 2016; Ling et al., 2013). Zivot Andrews advanced the original PP test and using an algorithm showed that the exact timing of the structural break can be known and hence considered structural break in the Zivot Andrews model (Muhamad, 2016). This test is used when data is very volatile. They designed three models to test unit root with structural break, model A and model B allow for a change in the intercept while model C allows for a change in both intercept and slope. Models follow below (Laurel, 2016; Ling et al. 2013; Mohamad et al., 2006):

Model A: Pure random walk, meaning no intercept and no time trend items

$$\Delta y_t = \mu + \alpha y_t + \beta_t + \theta DU_t + \sum_{j=1}^k c_j \Delta y_{t-1} + \varepsilon_t, \quad 49$$

Model B: Random walk with drift, meaning intercept and no time trend item;

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta_t + yDT_t^* + \sum_{j=1}^k c_j \Delta y_{t-1} + \varepsilon_t, \quad 50$$

Model C: Random walk with drift around stochastic trend, meaning intercept and time trend item;

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta_t + \theta DT_t^* + yDT_t^* + \sum_{j=1}^k c_j \Delta y_{t-1} + \varepsilon_t, \quad 51$$

where the intercept dummy for a mean shift occurring at each possible (TB) is $DU_t = 1$ if $t > T_B$ is tested and zero otherwise (T_B is the time break), the slope dummy $DT_t^* = t - T_B$ if $t > T_B$ and zero.

$$DU_t = \begin{cases} 1 & \text{if } t > TB \\ 0 & \text{otherwise} \end{cases} \text{ and,}$$

$$DT_t = \begin{cases} t - TB & \text{if } t > TB \\ 0 & \text{otherwise} \end{cases}$$

$H_0: \alpha = 0$ (series contains a unit root with a drift hence is non-stationary)

$H_a: \alpha < 0$ (series has one time break occurring at a known time and is a trend stationary)

Model 49, 50 and 51 are utilized in this analysis.

Katabi and Raphael (2018) note that if the computed absolute value of the tau statistic ($|\tau|$) exceeds the ADF or MacKinnon critical tau values, the time series is stationary. When the computed absolute value of the tau statistic does not exceed the ADF or MacKinnon critical tau values, the time series is non-stationary (Katabi & Raphael, 2018; Ambalal, 2018).

6.9.2.4 Runs Test

A runs test is a test for randomness. Curwin and Slater (2008:354) define a runs test as a test for randomness in a 'yes/no' type (dichotomised) variable. Scholars (Strong, 2010; Zhenmin, 2010) describe the runs test as a non-parametric technique that is used to test randomness of a sequence containing two kinds of items. It checks whether or not a serial correlation exists among the residuals in a regression analysis model. This non-parametric test is a classical and major test that has been used to test weak form efficiency and it complements the serial correlation test because results of runs tests are not seriously affected by outliers (Njuguna, 2014). A consecutive sequence of the same sign is considered as a run (Kevin, 2009). This means that the direction of the change in price values is considered in this test, an increase is represented by + sign and a decrease by a – sign, no change in prices is represented by zero.

The total number of runs for the calculated log returns of the NSE daily index prices were computed as follows as given by (Fama, 1965):

$$m = \frac{n(n+1) - \sum_{i=1}^3 n_i^2}{n},$$

where n is the total number of price changes and n_i ($i= 1,2,3$) are the number of price changes of each sign -, +, and zero

The Z value was then computed. Katabi and Raphael (2018) note that for large n the distribution of m is approximately normal and the Z – value is calculated as:

$$Z = \frac{r + \frac{1}{2} - m}{\sigma_m}, \quad 54$$

Katabi and Raphael (2018) indicate that where Z is the standard normal z statistic used in run test, r is the observed number of runs, the $\frac{1}{2}$ is the discontinuity adjustment factor and σ_m is the standard error of m given by:

$$\sigma_m = \left(\frac{\sum_{i=1}^3 n_i^2 \left[\sum_{i=1}^3 n_i^2 + n(n+1) \right] - 2n \sum_{i=1}^3 n_i^3 - n^3}{n^2 (n-1)} \right). \quad 55$$

A negative Z value implies that the observed number of runs is less than the expected number of runs and thus positively correlated. The opposite is true for a positive Z value and a Z value of more than 1.96 indicates non randomness (Biekpe, 2007). The P value is used to draw conclusion on randomness of the return series as tested by run test. If P value is less than the level of significance, the test will be significant at that chosen level of confidence – thus a p-value of less than alpha indicates rejection of the null hypothesis (Katabi & Raphael, 2018).

6.9.2.6 Variance ratio test

The variance ratio non-parametric test is a powerful random walk hypothesis test that was advanced by Lo and MacKinlay (1988). It was modified by Chow and Denning (1993) and Wright (2000), (Chen, 2008). The Lo and MacKinlay (1988) test is based on the property that the variance of increments of a random walk X_t , is linear in data intervals. This means that the variance of $(x_t - x_{t-q})$ is q times the

variance of $(x_t - x_{t-1})$. Therefore, the RWH can be checked by comparing $\frac{1}{q}$ times the variance of $(x_t - x_{t-q})$ to the variance of $(x_t - x_{t-1})$ (Chen, 2008:96).

If P_t is the exchange rate at time t and the random walk series X_t be the natural logarithm of P_t ($X_t = \ln P_t$). The variance ratio is defined as (Chen, 2008);

$$VR(q) = \frac{\sigma^2(q)}{\sigma^2(1)}, \quad 56$$

where $\sigma^2(q)$ is $\frac{1}{q}$ times the variance of $(x_t - x_{t-q})$ and $\sigma^2(1)$ is the variance of $(x_t - x_{t-1})$. The null hypothesis is that VRq is not statistically different from 1. The equations to calculate this $\sigma^2(q)$ and $\sigma^2(1)$ are

$$\sigma^2(1) = \frac{1}{nq-1} \sum_{t=1}^{nq} (X_t - X_{t-1} - \mu)^2, \quad 57$$

where

$$\mu = \frac{1}{nq} \sum_{t=1}^{nq} (X_t - X_{t-1}) = \frac{1}{nq} (X_{nq} - X_0), \quad 58$$

and

$$\sigma^2(q) = \frac{1}{m} \sum_{t=q}^{nq} (X_t - X_{t-q} - q\mu)^2, \quad 59$$

where

$$m = q(nq - q + 1) \left(1 - \frac{q}{nq} \right). \quad 58$$

X_{nq} is the last observation of the data time series. The observation starts at X_0 . There are $nq+1$ observations. The standard normal test statistic used to test the null hypothesis of random walk under the assumption of homoscedasticity is $Z(q)$ calculated as (Chen, 2008:99);

$$Z(q) = \frac{(VR(q)-1)}{\sqrt{\theta(nq)}} \sim N(0,1), \quad 59$$

where

$$\theta(q) = \frac{2(2q-1)(q-1)}{3q(nq)}, \quad 60$$

The standard normal test statistic used for heteroscedasticity-consistent is $Z(q)$, calculated as (Chen 2008:99);

$$Z^*(q) = \frac{(VR(q)-1)}{\sqrt{\theta^*(q)}} \sim N(0,1), \quad 61$$

where

$$\theta^*(q) = \sum_{j=1}^{q-1} \left[\frac{2(q-j)}{q} \right]^2 \delta(j), \quad 62$$

and

$$\delta(j) = \frac{\sum_{t=j+1}^{nq} (X_t - X_{t-1} - \mu)^2 (X_{t-j} - X_{t-j-1} - \mu)^2}{\left[\sum_{t=1}^{nq} (X_t - X_{t-1} - \mu)^2 \right]^2}, \quad 63$$

Where $\delta(j)$ is heteroscedasticity consistent estimator; μ is the average return, X_t is the average price of security at time t .

The test statistics $Z(q)$ and $Z^*(q)$ above are applied in this study. The hypotheses that are tested are:

H_0 : $VR(q) = 0$ (series is a random walk)

H_a : $VR(q) \neq 0$ (series is not a random walk)

According to scholars (Katabi and Raphael, 2018; Laurea, 2016; Ambalal, 2018; Chen, 2008), if the variance ratio is greater than one then the returns are positively correlated and can be concluded that the returns are positively correlated and conditional variance. As a result, the random walk under heteroskedasticity and homoscedasticity can be rejected, and a variance ratio of below one implies

negative serial correlation and conditional variances. A variance of one (1) implies no correlation – and thus the series follows that random walk hypothesis.

6.9.2.6 Threshold Autoregressive (TAR) Model

The TAR model is a nonlinear unit root test. According to Tsay (2010), this test was motivated by nonlinear data encountered in practice for example asymmetry found in declining and rising patterns of a process. TAR was first introduced by Tong (1978) and ever since there has been development on the test (Caner & Bruce, 2001). Tsay (2010) notes that the TAR model uses piecewise linear models to obtain a better approximation of the conditional mean equation. However, in contrast to the traditional piecewise linear model that allows for model changes to occur in the “time” space, the TAR model uses threshold space to improve linear approximation. Phiri (2015) explains that the TAR introduces asymmetric adjustments in the unit root testing procedure, for instance the Enders and Granger (1998) stems from the Dickey Fuller unit root testing regression:

$$p_t = \varphi p_{t-1} + \xi_t, \tag{64}$$

where, ξ_t is a white noise error term. In order to introduce asymmetric adjustments that accommodates the asymmetric behaviour, Enders and Granger (1998) suggest reformulating the equation in terms of the first difference. It is written as

$$\Delta p_t = I_t \psi_1 \xi_t + (1 - I_t) \psi_2 \xi_t, \tag{65}$$

where I_t is a zero one Heaviside indicator function which governs the regime switching behaviour of the error term ξ_t .

Enders and Granger (1998) and Caner and Hansen (2001) proved that standard time series models had low power in testing for unit root if the underlying data generating process (DGP) was nonlinear, thus justifying the use of nonlinear models. Also, the conventional unit root tests assumed linearity and symmetric adjustments in time series. As a result, the conventional unit root tests are not adequate for testing data generated in a nonlinear process. Therefore, Phiri (2015) explains that when there is asymmetry in a univariate time series, it is advisable to apply appropriate asymmetric unit root tests to determine randomness of the time series. Phiri (2015) applied the nonlinear TAR unit root tests advanced by Enders and Granger (1998) and Bec, Salem, and Carrasco (2004) to assess the integration properties

for both capitalis and three-regime processes, respectively. Both the TAR unit root tests are generalisations of the Dickey-Fuller unit root testing procedure.

Developing economies have been noted to generate data in a nonlinear process. Biekpe (2007) advises that the use of linear models in testing relationship of the return to ascertain random walk hypothesis (RWH) is inadequate in African markets which are assumed to be developing economies. This is because the assumptions on which EMH is based are believed to be violated due to the heterogeneity of investors and the weak microstructures of the African markets. More research is required to test RWH using nonlinear models. This led Abakah et al. (2018) to implement nonlinear models to test RWH in South Africa, Nigeria, Egypt, and Mauritius. Here, the Fourier Unit Root Test which captures structural changes was implemented.

The time series data that was analysed in this study was from an African Nation, Kenya, which is a developing economy. The data is assumed to have been generated in a nonlinear process and is asymmetrical in nature. For this purpose, the Threshold Autoregressive (TAR) model that considers structural breaks that are evidenced in data that is generated in a nonlinear process was implemented. The Enders and Granger (1998) and Bec, Salem, and Carrasco (2004) asymmetric unit root tests, also known as the two regime and three-regime threshold auto regressive tests (TAR) respectively, were used to analyse the NSE share price time series data. The two models are generalisations of the Dickey Fuller unit root testing model.

- **Two Regime TAR**

Considering the simple regression used as basis of the Dickey Fuller model:

$$\Delta y_t = \rho y_{t-1} + \varepsilon_t \quad 66$$

Where ε_t is a white-noise disturbance. This equation can be modified to introduce deterministic regressors, lagged changes in Δy_t , allowing for structural breaks and $\{\varepsilon_t\}$ to be weakly dependent and heterogeneously distributed (Enders & Granger, 1998). “The Dickey and Fuller test and its extensions are mis-specified if adjustment is asymmetric. Consider an alternative specification – called the threshold autoregressive (TAR) model- such that” (Enders & Granger, 1998: 305):

$$\Delta y_t = \begin{cases} p_1 y_{t-1} + \varepsilon_t & \text{if } y_{t-1} \geq 0 \\ p_2 y_{t-1} + \varepsilon_t & \text{if } y_{t-1} < 0 \end{cases} \quad 67$$

To test the null hypothesis of a unit root, the modified F statistic advanced by Enders and Silkos (2001), was used in this study. This is a test of the model regime coefficients, null hypothesis of, $\psi_1 = \psi_2 = 0$ against alternative hypothesis of a stationary two – regime TAR process in which the model coefficients differ and are both not equal to zero, that is, $\psi_1 \neq \psi_2 \neq 0$.

$$H_o : \psi_1 = \psi_2 = 0$$

Vs,

$$H_a : \psi_1 \neq \psi_2 \neq 0$$

If the F statistic is lower in absolute value in comparison with the critical values as tabulated in Enders and Granger (1998), the null hypothesis can be rejected. Following Phiri's (2015) advice, in case the time series becomes a three-regime mean reverting process as opposed to a capitalis process, the Three Regime TAR was implemented.

- **Three Regime TAR**

To further confirm results from two regime TAR, following Phiri (2015), the three-regime Threshold autoregressive (TAR) model advanced by Bec et al. (2004) was implemented because the series might be a three-regime mean reverting process:

$$\Delta p_t = \begin{cases} \mu_1 + \sigma_1 \Delta p_{t-1} + \delta_1 p_{t-1} & \text{if } -\infty < p_{t-1} \leq \tau_1 \\ \mu_2 + \sigma_2 \Delta p_{t-1} + \delta_2 p_{t-1} & \text{if } \tau_1 < p_{t-1} \leq \tau_2 \\ \mu_3 + \sigma_3 \Delta p_{t-1} + \delta_3 p_{t-1} & \text{if } \tau_2 < p_{t-1} \leq \infty \end{cases}, \quad 68$$

where; σ_1 is the regression coefficients and threshold τ is defined such that $\tau_2 = -\tau = \tau$. Restrictions of $\sigma_1 \leq 1$ are imposed on the regression coefficients to ensure that non stationarity can only be detected in the corridor regime of the three – regime process. The unit root procedure is based upon the statistical significance of the regression parameter σ_1 . (Phiri, 2015).

Hypotheses that were tested include:

$$H_0: \sigma_1 = \sigma_2 = \sigma_3; \delta_1 = \delta_2 = \delta_3 = 0.$$

$$H_a: |\sigma_1| < 1, |\sigma_2| < 0, |\sigma_3| \leq 0$$

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Threshold values of $\hat{\tau}$ that are used in the regression test are selected before testing (Phiri, 2015). These values are selected through eviews software. According to Phiri (2015), “the asymptotic distributions of these unit root tests are derived from Supremum based tests on the Wald, Lagrange Multiplier and the Likelihood ratio”. The Wald (W) and Lagrange Multiplier (LM) were applied in this study. If the resulting test statistics are smaller in value in comparison to their computed critical values, then the time series is stationary (Phiri, 2015).

The Wald test is written as

$$WT = T \left(\frac{\sigma_0^2}{\sigma^2} - 1 \right), \quad 70$$

where

σ^2 is the residual variance and σ_0^2 is residual variance from OLS estimation (Caner & Hansen, 2001).

While the Lagrange Multiplier (LM) is given by;

$$LM = s'_e \left(Cov(s') \right)^{-1} s_e = \left(K\hat{s} \right)' \left(Cov(Ks) \right)^{-1} K\hat{s} = s'K' \left(KCov(s)K \right)^{-1} K\hat{s}. \quad 71$$

6.10 Model specification for determining whether the current NSE stock indices are representative for the Kenyan capital market

This study set out to determine whether the NSE share indices are market representative for the introduction of index funds. The relationship between the market performance as measured by the NSE All share index (NASI) and the NSE 25 share index, the NSE 20 share index, the FTSE NSE Kenya 15 Share Index, the FTSE NSE Kenya 25 Share Index daily stock returns were analysed using the Pairwise Granger Causality test (Granger, 1969).

6.10.1 Pairwise Granger Causality Test

Granger Causality tests analyse the relationship between two sets of time series variables x and y. (Kumo, 2012; Mellon, 2018) mention that Granger (1969) uses a time series data-based approach to determine causality between economic variables. This study follows Kirchgassner and Wolters' (2007) definition

of the Granger causality. The authors explain that in a case where I_t is the total time series set x and y available at time t and if \bar{x}_t be all past and current values of x , then,

$$\bar{x} = \{x_t, x_{t-1}, \dots, x_{t-k}, \dots\}, \quad 72$$

and analogously y . In such a case, Granger (1969) proposes three definitions of causality between x and y , where σ^2 is the variance of the corresponding forecast error. The three definitions are: Granger causality is defined as x granger causes y if an optimal linear prediction function leads to $\sigma^2(y_{t+1}|I_t) < \sigma^2(y_{t+1}|I_t - \bar{x}_t)$. Secondly, Instantaneous Granger Causality is defined as x is instantaneously Granger causes y if and only if the application of an optimal linear prediction function leads to $\sigma^2(y_{t+1}|\{I_t, x_{t+1}\}) < \sigma^2(y_{t+1}|I_t)$.

Lastly, there is feedback if between x and y if x is causal to y and y is causal to x (Kirchgassner & Wolters 2007). The authors add that, “feedback is only defined for the case of simple causal relations, because, direction of instantaneously causal relations cannot be identified without additional information or assumptions. Thus, the following theorem holds: x is instantaneously causal to y if and only if y is instantaneously causal to x . As a result of these definitions, there are eight different possibilities of causal relations between two-time series where only current and time lagged variables of two-time series sets are considered (x and y).

The 8 causal relations are:

- i) x and y are independent: (x, y)
- ii) There is only instantaneous causality: $(x \rightleftarrows y)$
- iii) x is causal to y , without instantaneous causality: $(x \longrightarrow y)$
- iv) y is causal to x , without instantaneous causality: $(x \longleftarrow y)$
- v) x is causal to y , with instantaneous causality: $(x \rightleftarrows y)$
- vi) y is causal to x , with instantaneous causality: $(x \rightleftarrows y)$
- vii) There is feedback without instantaneous causality: $(x \longleftrightarrow y)$
- viii) There is feedback with instantaneous causality: $(x \rightleftarrows y)$

Therefore, the Pairwise Granger Causality non-parametric test (Granger, 1969) was used in this study to analyse the causality within two sets of time series. The NSE All share index as mentioned is a measure

of the Kenyan market performance because it is market representative index that comprises of all companies listed on the NSE. Kumo (2012) describes Granger Causality as a time series x is a cause of y if it is useful in forecasting y . This means that the current value of Y (y_t) is predicted by past values of X ($x_{t-1}, x_{t-2}, \dots, x_0$).

This study tests eight sets of bidirectional hypotheses using the pairwise Granger Causality test:

H_0 : FTSE NSE 15 does not Granger Cause NASI

H_0 : NASI does not Granger Cause FTSE NSE 15

H_0 : FTSE NSE 25 does not Granger Cause NASI

H_0 : NASI does not Granger Cause FTSE NSE 25

H_0 :NSE 20 does not Granger Cause NASI

H_0 :NASI does not Granger Cause NSE 20

H_0 :NSE 25 does not Granger Cause NASI

H_0 :NASI does not Granger Cause NSE 25

Following Mellon (2018), two variables were analysed simultaneously. The results were either unidirectional Granger causality from variable Y_t to variable X_t , or unidirectional Granger causality from variable X_t to variable Y_t , bi-directional causality between variable X_t and variable Y_t and no causality between variable X_t to variable Y_t . The lag length was determined by Akaike Information Criteria (AIC).

The null hypothesis was tested using the following VAR model:

$$Y_t = a_0 + a_1 Y_{t-1} + \dots + a_p Y_{t-p} + b_1 X_{t-1} + \dots + b_p X_{t-p} + U_t. \quad 73$$

$$X_t = c_0 + c_1 X_{t-1} + \dots + c_p X_{t-p} + d_1 Y_{t-1} + \dots + d_p Y_{t-p} + U_t. \quad 74$$

In line with Kumo (2012), the Granger Causality test uses the F test. This test was used to check whether the lagged information on a variable Y provides statistically significant information about variable X . If the p-value is < 0.05 reject H_0 .

6.11 Analysis Procedure:

The following steps are carried out in data analysis:

1. Organise the indices data in a one-dimensional array
2. Pre-analysis
 - Carry out log transformation
 - Check for stationarity through graphical presentation of log transformed data. If data is not covariance stationary, proceed to the next step that is differencing.
 - Check for order of integration $y_t \sim I(d)$, that is at what level of differencing will the data be stationary to allow for ARIMA models for analysis. If the series needs to be differenced once then y_t is an ARIMA (p,1, q) process with a unit root, if the series needs to be differenced twice then y_t is an ARIMA (p, 2, q) process and it has double unit roots (Tsay, 2010). This is achieved through graphical presentation of differenced data.
 - Generate descriptive statistics of transformed data.
 - Application of tests of normality. If data is symmetrical which is an indication of linear data generating process, apply linear unit root tests. If data is asymmetrical which is an indication of nonlinear data generating process, then apply both linear and nonlinear unit root tests.
3. Application of Q-test to confirm stationarity of data after differencing. This test follows asymptotically the standard normal distribution, and the test statistic is the t ratio. The null of $H_0 : P_t = 0$ is tested versus the alternative $H_a : p_t \neq 0$. The null hypothesis H_0 is rejected if the p value of the t ratio is small, that is it is less than 0.05. The presence of auto correlation indicates stationarity (Ananzeh, 2014; Katabi & Raphael, 2018; Shaalan, 2019).
4. Application of linear unit root tests that is the Augmented Dickey Fuller (ADF) and the Phillip Perron (PP) tests to check on presence of unit roots.
 - Application of the linear Zivot Andrews unit root test where; $H_0 : \alpha = 0$ (series contains a unit root with a drift hence is non- stationary) and $H_a : \alpha < 0$ (series has one –time break occurring at

a known time and is a trend stationary). Model 96,97 and 98 are utilized in this analysis. This study applies the t test and the Mackinnon (1991) Tau (τ) critical values.

5. The runs test is applied as a confirmatory test.
 - A negative Z value implies that the observed number of runs is less than the expected number of runs and thus positively correlated. The opposite is true for a positive Z value and a Z value of more than 1.96 indicates non randomness (Biekpe, 2007). P value is used to draw conclusion on randomness of the return series as tested by run test. If a P value is smaller than the level of significance, the test will be significant at that chosen level of confidence hence a p-value of less than alpha indicates rejection of the null hypothesis (Katabi & Raphael, 2018).

6. Application of Variance Ratio (VR). The test statistics $Z(q)$ and $Z^*(q)$ are applied in this study.
 - The hypotheses that are tested include:

$$H_0: VR(q) = 0 \text{ (series is a random walk)}$$

$$H_a: VR(q) \neq 0 \text{ (series is not a random walk)}$$

According to scholars (Katabi and Raphael, 2018; Laurea, 2016; Ambalal, 2018; Chen, 2008), if the variance ratio is greater than one, the returns are positively correlated and it can be concluded that the returns are positively correlated and conditional variance. As a result, the random walk under heteroskedasticity and homoscedasticity can be rejected. A variance ratio of below one implies negative serial correlation and conditional variances. A variance of one (1) implies no correlation, and thus the series follows the random walk hypothesis.

7. If data is asymmetrical, the nonlinear unit root test can be used to check for the presence of unit roots.
 - The capitalis nonlinear TAR test is applied. To test the null hypothesis of a unit root, the modified F statistic advanced by Enders and Silkos (2001) is used. This is a test of the model regime coefficients, that is, $\psi_1 = \psi_2 = 0$ against alternative hypothesis of a stationary two – regime TAR process in which the model coefficients differ and are both not equal to zero, that is, $\psi_1 \neq \psi_2 \neq 0$

. If the F statistic is lower in absolute value in comparison with the critical values as tabulated in Enders and Granger (1998), the null hypothesis can be rejected.

- The three-regime TAR is utilised, because the series might be a three-regime mean reverting process. σ_1 is the regression coefficients and threshold τ is defined such that $\tau_2 = -\tau = \tau$.

Hypotheses that are tested include:

$$H_0: \sigma_1 = \sigma_2 = \sigma_3; \delta_1 = \delta_2 = \delta_3 = 0$$

$$H_a: |\sigma_1| < 1, |\sigma_2| < 0, |\sigma_3| \leq 0$$

- The Wald (W) and Lagrange Multiplier (LM) test statistics are applied in this study. If the resulting test statistics are smaller in value in comparison to their computed critical values, the time series is stationary (Phiri, 2015).

8. Application of Granger Causality to check for representativeness of indices. The null hypothesis was tested using the following VAR model: $Y_t = a_0 + a_1 Y_{t-1} + \dots + a_p Y_{t-p} + b_1 X_{t-1} + \dots + b_p X_{t-p} + U_t$

$$X_t = c_0 + c_1 X_{t-1} + \dots + c_p X_{t-p} + d_1 X_{t-1} + \dots + d_p X_{t-p} + U_t$$

In line with Kumo (2012), the Granger Causality test uses the F test. This test is used to check whether the lagged information on a variable Y provides statistically significant information about variable X. If the p-value is < 0.05 reject H_0 .

6.12 Assessing and demonstrating the quality and rigor of the proposed research design

The quality and rigor of the proposed research design was demonstrated through ensuring that ethical standards are adhered to from the commencement of the study to the end.

6.12.1 Research ethics

This study was conducted in an ethical manner, keeping in mind that high ethical standards are required in any research study. Gay et al. (2009) explain that ethical considerations play a role in all research studies, and all researchers must be aware of and attend to ethical requirements in their work.

Gall et al. (2007) further note that data collection and analysis of empirical data, which is the heart of research, is unfortunately an area prone to ethical misconduct, through the manipulation of data or manipulation of analysis and results. The authors point out with concern that plagiarism is another an ethical issue of growing concern. The researcher of the present study is and was committed to acting

ethically throughout the study and adhered to the rules of the NWU Institutional Research Ethics Regulatory Committee (IRERC) as shown in Appendix C and abide to the ethical principles and responsibilities as set out in the Singapore statement on research integrity (22 September 2010). The researcher applied for ethical approval and clearance to the North-West University Economic and Management Sciences Research Ethics Committee and obtained research ethics clearance number NWU-00952-21-A4. Ethical approval and clearance were done during the conceptualisation of the study, before commencement of the actual study.

The data collection and data analysis process were handled in an ethical manner. Time series data for the five indices were readily available and could be acquired from the Bourse easily. The researcher obtained data from the NSE and the FTSE data streams for the periods discussed above. This collected data was utilised in the manner it was collected, and missing data and repeated data were handled as discussed in the study. The data was therefore not manipulated, but it was analysed in the state it was obtained. Data analysis was done by employing methods that were discussed in this chapter. The researcher did not stray from the models discussed and the reasoning behind the methods utilised was maintained. The research is a quantitative study, and therefore the discussed quantitative methods were utilised.

The process of compiling and reporting data was also done in an ethical manner. Results were reported as obtained from the analysis using the respective models. The dependency of the indices returns were analysed, and this led to conclusions regarding their predictability and decision as to whether or not index funds could be introduced to the Kenyan financial market. The researcher maintained objectivity and eliminated bias by reporting the results accurately. From these results, a framework for the introduction of index funds was developed and conclusions about the study are presented.

CHAPTER 7

Results

7.1 Introduction

This chapter presents the results of the study. The purpose of the study is to investigate the suitability of introducing index funds in the Kenyan capital markets, and to formulate a framework for the introduction of index funds. The research thus assesses the weak form Efficient Market Hypothesis (EMH) for the NSE and determines whether the current stock indices are representative of the Kenyan capital markets.

The study analyses daily index returns for five share indices obtained from the Nairobi Securities Exchange (NSE). The indices comprise of the NSE 20 share index, the NSE 25 share index, the FTSE NSE Kenya 15 share index, the FTSE NSE Kenya 25 share index and the NSE All Share Index (NASI). The study utilises the serial correlation (Ljung-Box test), as well as linear and non-linear unit root tests to analyse the data. The linear tests include the Augmented Dickey Fuller test, the Phillip –Perron (PP) test, the Zivot Andrews test, the runs test and the variance ratio test. Two nonlinear models are used, namely the capitalis threshold autoregressive test (TAR) and the three-regime threshold autoregressive test (TAR). Furthermore, the pairwise Granger Causality test was utilised to assess the market representativeness of the NSE indices. Results from all the tests are presented in this chapter.

Section 7.2 presents data description all the five indices' data. Subsequently, Section 7.3 presents the results of tests that assessed the weak form Efficient Market Hypothesis (EMH) for the NSE. Section 7.4 presents the results pertaining to whether the current stock indices are representative of the Kenyan capital markets.

All the tests were implemented in Eviews and Stata software, and the statistical level of significance is assumed to be 5%, unless stated otherwise.

7.2 Data description

Daily closing prices of the indices were collected from the NSE and FTSE Russel data stream. The Bourse only generated data during business days, and therefore, the series obtained indicate missing values due to weekends and public holidays. To correct for the missing days, a business calendar was created with appropriate centre dates for each of the indices data set. The study therefore focused on the capital market trading days. Duplicate values present in the NSE 20 share index, NSE 25 share index, and the NSE All Share Index were omitted in readiness for analysis.

The sample period for this study was from January 2010 to December 2020. The sample data points within the period chosen and the indices chosen comprised of 15,704 observations. The observations comprised of daily indices prices.

The daily closing prices had total observations of 15,704, for an eleven-year period (January 2010 to December 2020). The NSE 20 Share Index had 2, 755 observations for the period 04 January, 2010 to 31 December, 2010, the NSE 25 Share Index had 1,333 observations for the period 01 September, 2015 to 31st December 2020, the FTSE NSE Kenya 15 Share Index had 2, 765 observations for the period 04 January, 2010 to 31 December, and the FTSE NSE Kenya 25 Share Index had 2, 765 observations for the period 04 January, 2010 to 31 December, and the NSE All-Share Price Index (NASI) had 2, 756 observations for the period 04 January, 2010 to 31 December.

In addition, in order to achieve the two objectives of this study, the log-returns for the indices were calculated by using the first log difference of the daily index prices for the selected stock indices.

$$R_t = [\ln(p_t) - \ln(p_{t-1})],$$

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right),$$

where:

R_t = Return of price index at time t

p_t = Price at time t

p_{t-1} = Price at time t - 1

7.3 Descriptive statistics

This section presents descriptive statistics and plots for the daily closing prices and daily closing returns for all the five indices. A visual presentation of all the series data was possible through line graphs and other graphs such as the histograms and the Q-Q plots. Tests of normality results for all the indices data are also presented in this section.

7.3.1 Summary of descriptive statistics of the NSE 20 share index

This sub-section presents descriptive statistics for the Nairobi Securities Exchange (NSE) index, the NSE20 share index, for the period ranging from of January 4, 2010, to December 31, 2020, which is an eleven-year period.

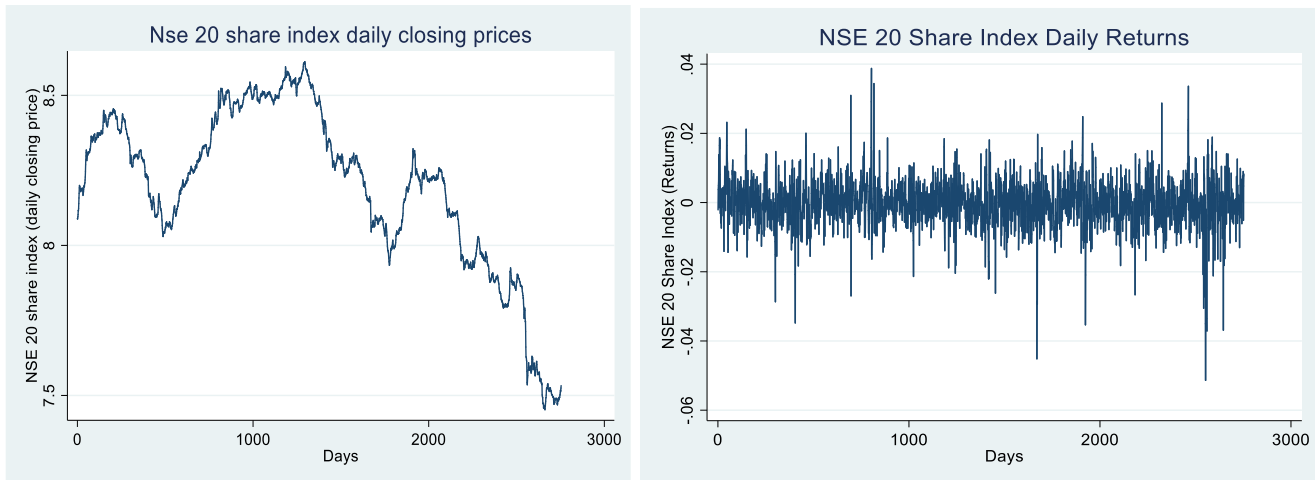


Figure 7.1 plots of the NSE 20 share index daily closing price and daily closing returns

Figure 6.1 displays the plots for the NSE 20 share index daily closing prices as well as returns for over the same time period. The NSE 20 index daily closing price plot displays downward trend. The NSE 20 share index returns series data shows that the series has a constant mean, implying stationarity after differencing. Thus, stationarity is achieved after first order differencing. In addition, the return series plot has high fluctuations around the mean, indicating high volatility. This may be explained by structural changes within the Kenyan economy, regulatory changes, and thin trading that characterise emerging economies, unreliable information, and political instability.

Table 7.1 Summary of the descriptive statistics of the NSE 20 share index returns

Observation	Mean	Median	Minimum	Maximum	Std deviation	Skewness	Kurtosis	Jarque - Bera
2,754	-.0002023	-.0001016	-.0513825	.038765	.0067662	-.4452124	8.297298	3311.022 p-value =0.000**

The series has a mean of $-.0002023$, a skewness of $-.4452124$, and kurtosis of 8.297298 , which suggest that the NSE 20 daily return values do not follow normal distribution. The kurtosis value of 8.297298 is higher than 3, indicating that the returns do not follow normal distribution but instead seems to follow a fat tailed leptokurtic distribution.

Tests of normality that were implemented confirmed that the NSE20 share index daily returns were not

normally distributed. The Jarque-Bera test was 3311.022, with a p-value = 0 and Shapiro – Wilk test of normality indicate the values shown in Table 7.1.

Table 7.2 NSE 20 Share index Shapiro Wilk W test of normality

Variable	Obs	W	V	Z	Prob>z
NSE20I~X	2,754	0.948	81.916	11.336	0.000

The p-value for both tests is zero, which is less than the significance level of 0.05, This suggests the daily return values of the index do not follow normal distribution, thus rejecting the null hypothesis. In conclusion, both the graphical plots and tests of normality results presented suggest that the NSE 20 share index daily returns values do not follow a normal distribution.

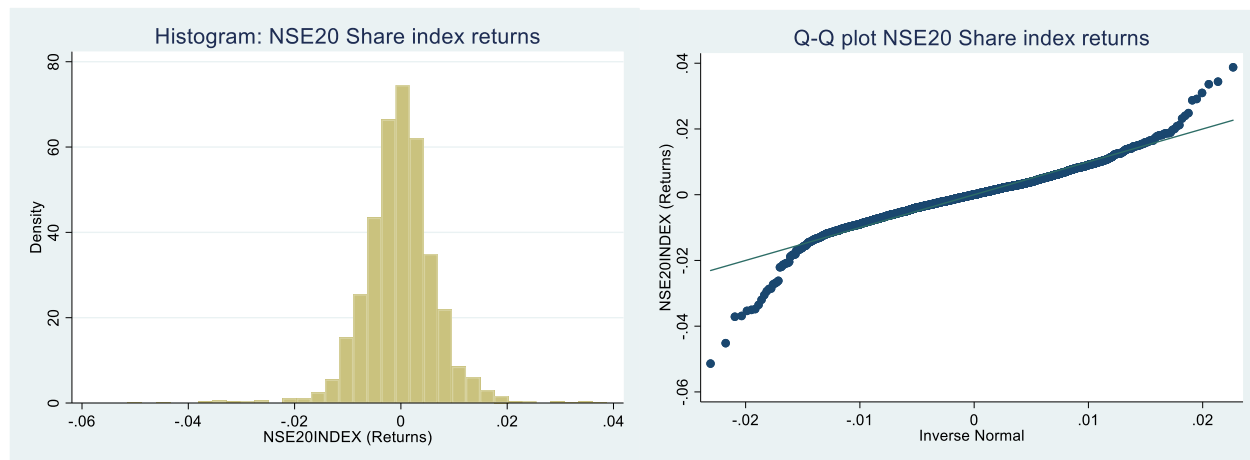


Figure 7.2 Histogram and Q-Q plot of the NSE 20 share index returns

As additional confirmation of leptokurtosis, the histogram and Q-Q plot of the NSE 20 share daily returns displayed in Figure 7.2 indicates leptokurtic distribution. The return values on the Q-Q plot deviate at both ends from the line of normality, indicating a leptokurtic distribution. Also, the histogram shows a distribution that has a high peak concluding leptokurtosis.

7.3.2 Summary of descriptive statistics of the NSE 25 share index

This sub-section discusses descriptive statistics for the Nairobi Securities Exchange (NSE) index, the NSE 25 share index, for the period of September 01, 2015, to December 31, 2020 – a six-year period.

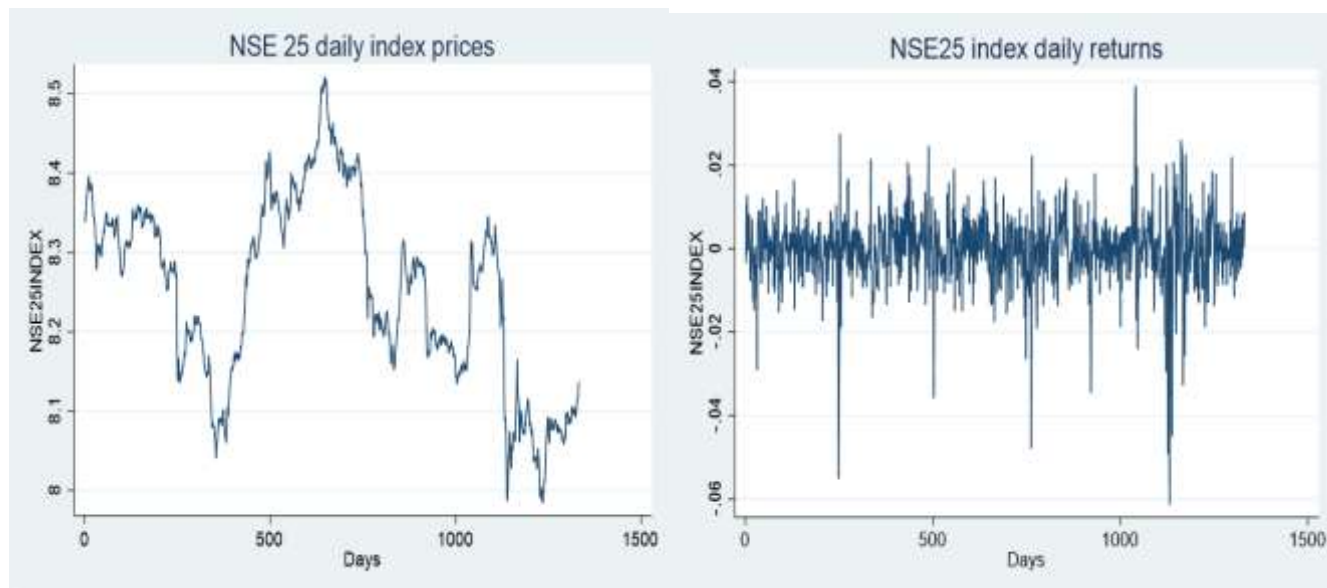


Figure 7.3 Plots of the NSE 25 share index daily closing price and daily closing returns

The line graph displayed above in Figure 7.2 for the NSE 25 share index daily closing prices clearly shows a downward trend with fluctuating mean indicating non stationarity. On the other hand, the NSE 25 share index returns series line graph displayed on Figure 7.3 presents a constant mean, implying stationarity after differencing. In addition, the return series plot has high fluctuations around the mean indicating high volatility.

Table 7.3 Summary of the descriptive statistics of the NSE 25 share index returns

Observation	Mean	Median	Minimum	Maximum	Std deviation	Skewness	Kurtosis	Jarque – Bera
1332	-0.000155	2.86E-05	-0.061273	0.038889	0.008385	-1.125042	11.24999	4058.446 p-value =0.000**

The descriptive results in Table 7.3 above show a mean of -0.000155, skewness of -1.125042, and kurtosis of 11.24999, these values are not equal to zero, meaning that the returns are not normally distributed. The kurtosis value of 11.24999, which is higher than 3, gives further confirmation that the returns do not follow normal distribution, but seem to follow a leptokurtic distribution, which is fat tailed.

Tests of normality were implemented to statistically test for normality. The hypothesis being tested was a null hypothesis; the series follows a normal distribution and alternate hypothesis; the series does not follow normal distribution. The Jarque-Bera test value was 4058.446, with a p-value of 0.000 and the Shapiro-Wilk test of normality presented the following results:

Table 7.4 NSE 25 share index Shapiro-Wilk W test of normality

Variable	Obs	W	V	Z	Prob>z
NSE25I~X	1,332	0.903	79.736	10.968	0.000

The p-value for both tests shown in Table 7.4 is zero, which is less than alpha 0.05 – suggesting that the daily return values of the index do not follow normal distribution. As a result, the null hypothesis of normality is rejected. In conclusion, both the graphical plots and tests of normality results suggest that the NSE 25 share index’s daily returns values do not follow a normal distribution

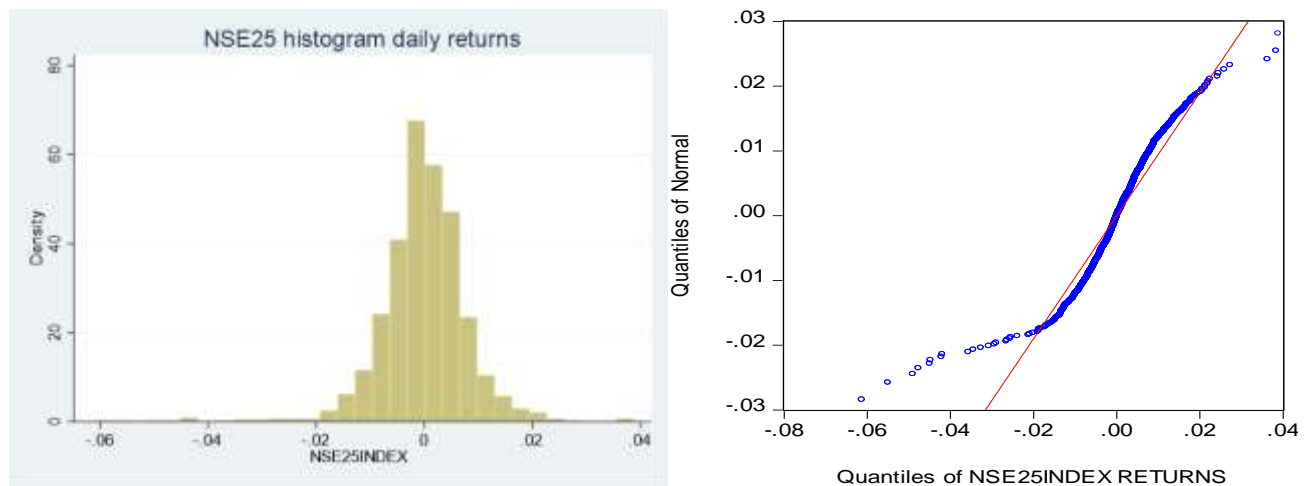


Figure 7.4 Histogram and Q-Q plot of the NSE 25 share index returns

Further confirmation of non-normality is shown by the histogram and Q-Q plot in Figure 6.4, which shows characteristics of a leptokurtosis distribution of the NSE 25 daily returns. The histogram shows a distribution that has a high peak concluding leptokurtosis. Likewise, the Q-Q plot of the returns indicates fat tails and leptokurtosis, because both ends of the Q-Q plot deviate from the straight line of normality.

7.3.3 Summary of descriptive statistics of the FTSE NSE 25 share index

This sub-section presents descriptive statistics for the Nairobi Securities Exchange (NSE) index and the FTSE NSE 25 share index, for the period of January 04, 2010, to December 31, 2020 – an eleven-year period.

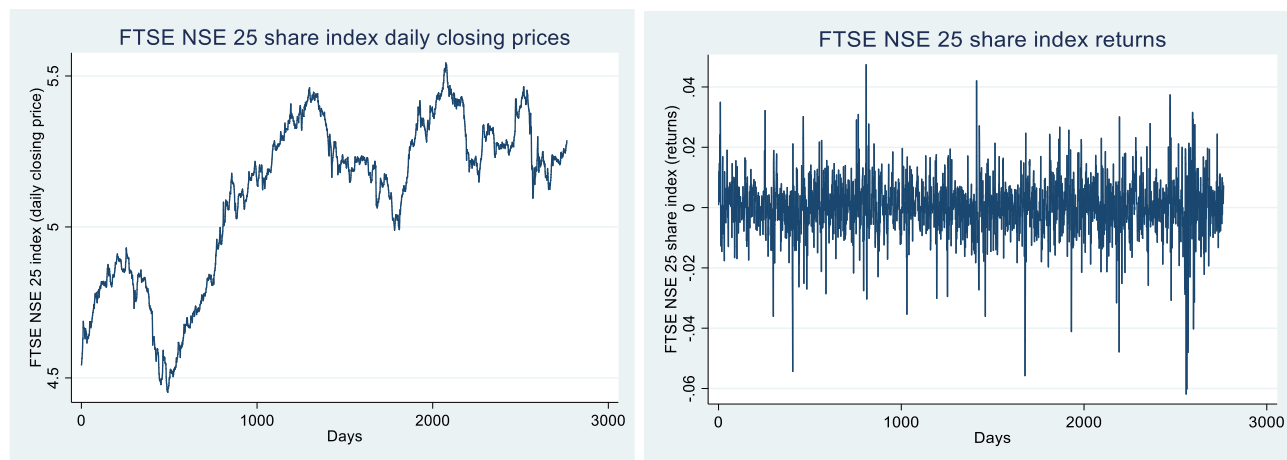


Figure 7.5 Plot of the FTSE NSE 25 share index daily closing price and daily closing returns

Similar to the NSE 20 and the NSE 25 share indices, the FTSE NSE 25 share index daily closing prices line graph displayed above show an upward trend and fluctuating mean, indicating non-stationarity. Furthermore, the daily closing returns of the FTSE NSE 25 share index line graph displays constant mean implying stationarity. In addition, the return series plot has high fluctuations around the mean, indicating high volatility.

Table 7.5 Summary of the descriptive statistics of the FTSE NSE 25 share index returns

Observation	Mean	Median	Minimum	Maximum	Std deviation	Skewness	Kurtosis	Jarque - Bera
2764	0.000269	0.000417	0.047385	-0.061838	0.008903	-0.673631	8.881104	4192.355

In a case of normal distribution, the mean, skewness and kurtosis would be equal to zero. The descriptive results of this series shown in Table 7.5, however, indicate a mean of 0.000269, skewness of -0.061838, and kurtosis of 8.881104. These values, not equal to zero, suggest that returns are not normally

distributed. The kurtosis value presented is 8.881104, which is higher than 3. This provides further confirmation that the series does not follow normal distribution, but rather seems to follow a leptokurtic distribution with fat tails.

There is further evidence from tests of normality that the series does not follow normal distribution. The Jarque-Bera test and Shapiro-Wilk test of normality were conducted. The null hypothesis that was tested was that either the series follows normal distribution, while the alternate hypothesis was that the series does not follow normal distribution. The Jarque-Bera test yielded 4192.355 with a p-value of 0.000, and the Shapiro-Wilk test of normality's results are as shown below in Table 7.6:

Table 7.6 FTSE NSE 25 share index Shapiro-Wilk W test of normality

Variable	Obs	W	V	Z	Prob>z
dlogFTSENS	2,764	0.934	104.796	11.971	0.000

The p-value for both tests is zero, which is less than alpha 0.05. This suggests that the daily return values of the index do not follow a normal distribution, and as a result, the null hypothesis of normality is rejected. In conclusion, both the graphical plots and tests of normality results presented suggest that the FTSE NSE 25 share index daily returns values do not follow a normal distribution.

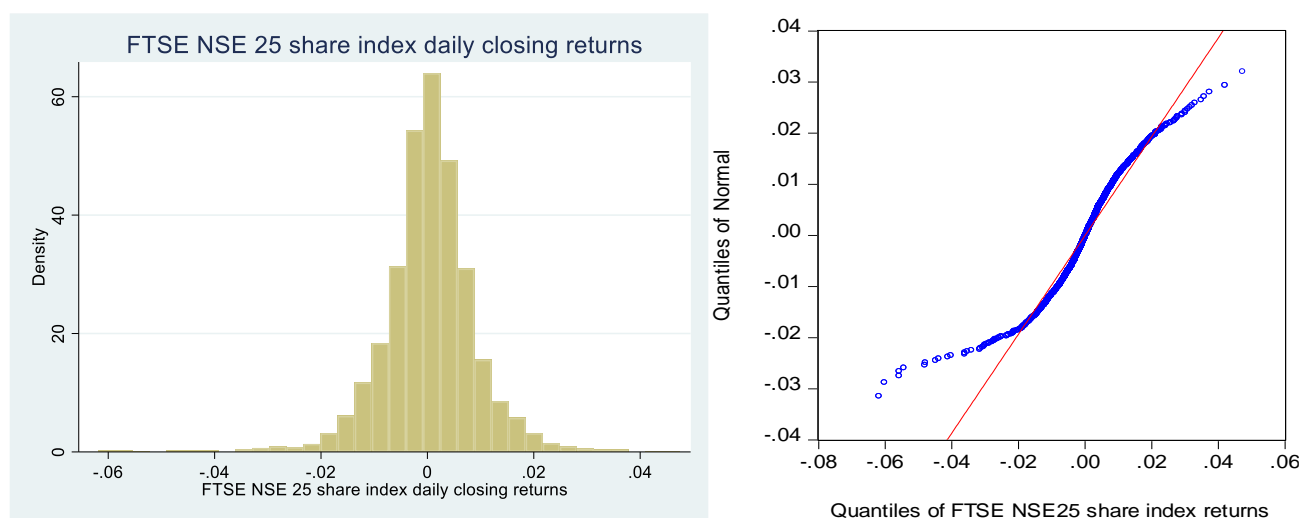


Figure 7.6 Histogram and Q-Q plot of the FTSE NSE 25 share index returns

There is further evidence suggesting non-normality from the Q-Q plot and the histogram. Both ends of the Q-Q plot of the FTSE NSE 25 share return series deviate from a straight line of normality – an indication of leptokurtosis and fat tails. To confirm this, the histogram graph of the FTSE NSE 25 share index daily returns shows a distribution that has a high peak concluding leptokurtosis.

7.3.4 Summary of descriptive statistics of the FTSE NSE 15 share index

This sub-section presents descriptive statistics for the Nairobi Securities Exchange (NSE) index, the FTSE NSE 15 share index, for the period of January 04, 2010, to December 31, 2020 – an eleven-year period.

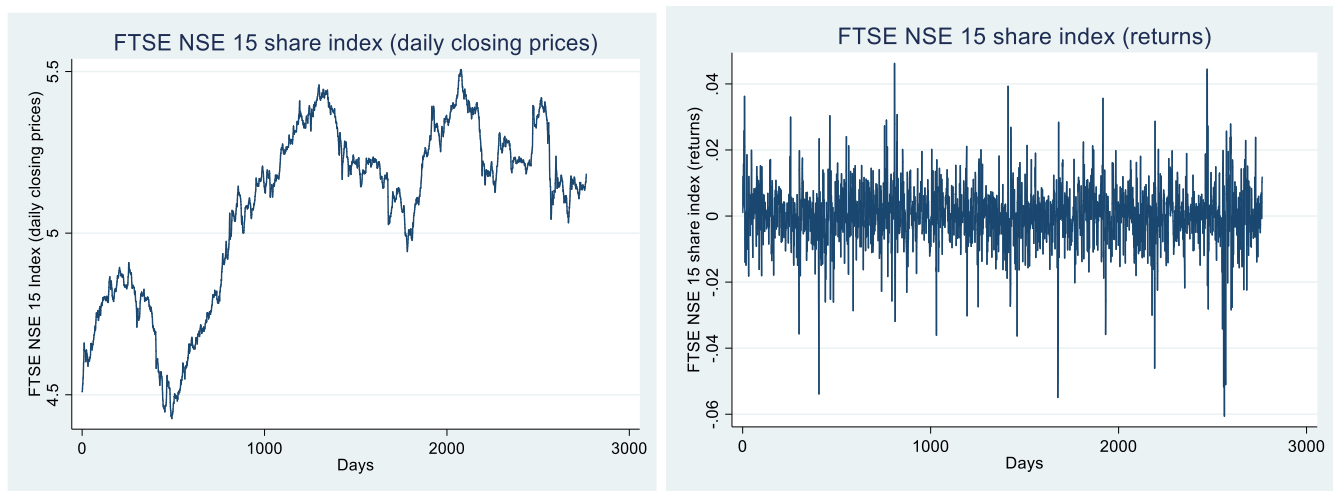


Figure 7.7 Plot of the FTSE NSE 15 share index daily closing price and daily closing returns

The FTSE NSE 15 share index daily closing prices plot displayed in Figure 7.7 above imply that the series has an upward trend and fluctuating mean indicating non stationarity. On the other hand, the returns series shows data that has a constant mean implying stationarity after differencing. Thus, stationarity is achieved after first order differencing. In addition, the return series plot has high fluctuations around the mean, indicating high volatility.

Table 7.7 Summary of the descriptive statistics of the FTSE NSE 15 share index returns

Observation	Mean	Median	Minimum	Maximum	Std deviation	Skewness	Kurtosis	Jarque - Bera
2764	0.000244	0.000314	-0.060588	0.046213	0.008700	-0.583931	8.969882	4261.558

Furthermore, the descriptive results of the FTSE NSE share index daily closing returns shown in Table 7.8 above indicate a mean of 0.000269, skewness of -0.061838, and kurtosis of 8.881104. These values are not equal to zero, and in the event that the distribution is normally distributed the mean, skewness and kurtosis would be equal to zero. This means that the returns are not normally distributed. The kurtosis value presented is 8.881104, which is higher than 3 – and this gives further impetus to the finding that the returns do not follow normal distribution, but instead a leptokurtic distribution with fat tails.

The following hypothesis were tested using Jarque-Bera and Shapiro-Wilk tests of normality: the hypothesis; Ho: series follows normal distribution and Ha: series does not follow normal distribution were tested. The Jarque-Bera test value was 4261.558 with a p-value of 0.000, and the Shapiro-Wilk test of normality’s results are shown in Table 7.8:

Table 7.8 FTSE NSE 15 share index Shapiro-Wilk W test of normality

Variable	Obs	W	V	Z	Prob>z
FTSENS~X	2,764	0.932	108.353	12.057	0.000

The p-value for both tests is zero, which is less than alpha 0.05. This suggests that the daily return values of the index do not follow normal distribution, and as a result, the null hypothesis of normality is rejected. In conclusion, both the graphical plots and tests of normality results presented suggest that the FTSE NSE 15 share index daily return values do not follow a normal distribution.

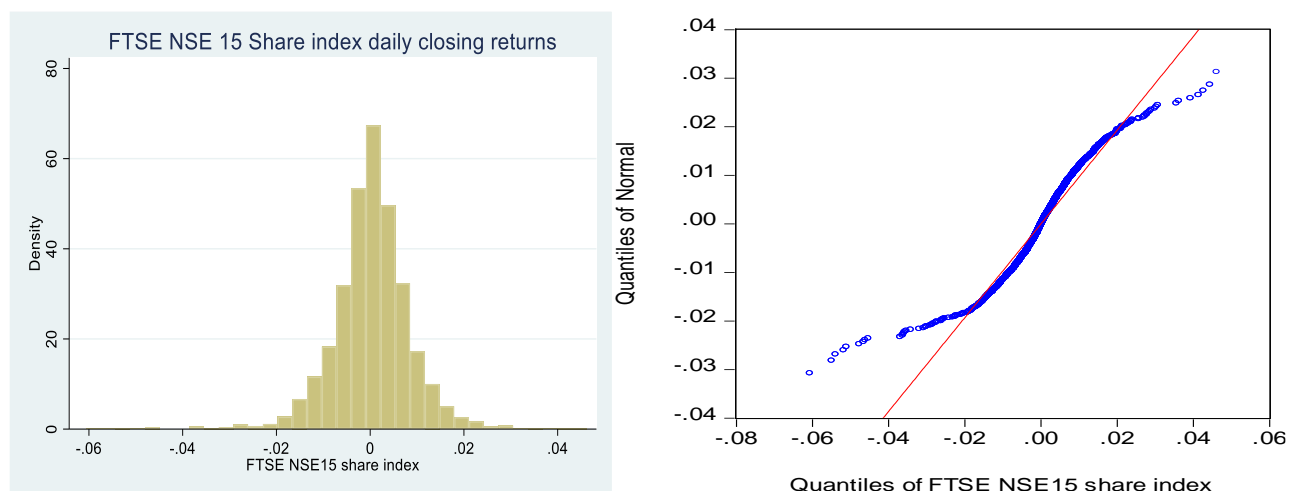


Figure 7.8 Histogram and Q-Q plot of FTSE NSE 15 share index returns

The histogram graph above in Figure 7.8 of the FTSE NSE 15 share index daily returns show a distribution that has a high peak, suggesting leptokurtosis. To further describe the series, the Q-Q plot of the returns indicates fat tails and leptokurtosis, because both ends of the Q-Q plot deviate from a straight line of normality. This indicates that the return series does not follow a normal distribution.

7.3.5 Summary of descriptive statistics of the NSE All share index (NASI)

This sub-section presents descriptive statistics for the Nairobi Securities Exchange (NSE) index, the NSE All share index (NASI), for the period of January 4, 2010, to December 31, 2020 – an eleven-year period.

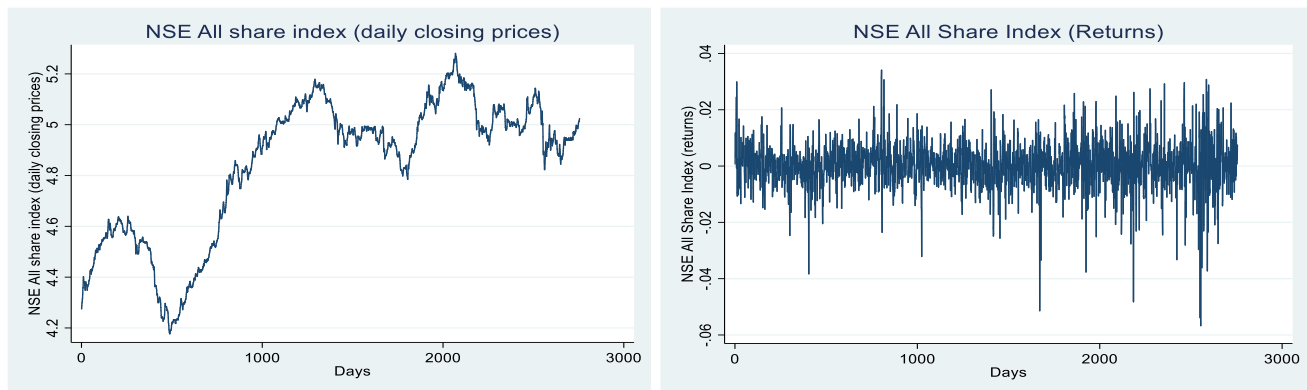


Figure 7.9 Plot of the NSE all share index (NASI) daily closing price and daily closing returns

The graph displayed above in Figure 7.9 for the NSE All share index daily closing prices indicates that the series displays an upward trend with fluctuating mean indicating non stationarity. Similar to the aforementioned indices, the returns series shows data that the series has a constant mean implying stationarity after differencing. Thus, stationarity is achieved after first order differencing. In addition, the return series plot has high fluctuations around the mean, indicating high volatility.

Table 7.9 Summary of the descriptive statistics of the NSE all share index (NASI) returns

Observation	Mean	Median	Minimum	Maximum	Std deviation	Skewness	Kurtosis	Jarque - Bera
2755	0.000272	0.000308	-0.056717	0.034084	0.007812	-0.675661	8.911397	4220.969

The results indicate a mean of 0.000272, skewness of -0.675661, and kurtosis of 8.911397 – these suggest that the returns values do not follow normal distribution, because the values are not equal to zero. The

kurtosis value is higher than 3, giving further confirmation that the returns do not follow normal distribution – instead, a leptokurtic distribution with fat tails.

Tests of normality were conducted to statistically determine whether the NSE all share index returns did not follow normal distribution. The Jarque-Bera test and the Shapiro-Wilk test of normality was implemented. The JarqueBera test value was 4220.969, and its p-value was zero; the Shapiro – Wilk test of normality yielded the results indicated in Table 7.10 below:

Table 7.10 NSE All share index Shapiro-Wilk W test of normality

Variable	Obs	W	V	Z	Prob>z
dlogNASI	2,755	0.936	102.149	11.904	0.000

The p-value for both tests is zero, which is less than the p-value of 0.05, and thus the test is statistically at the 5% level. This suggests that the daily return values of the index do not follow a normal distribution, hence rejecting the null hypothesis. In conclusion, both the graphical plots and tests of normality results presented confirm that the NSE All share index returns values do not follow a normal distribution.

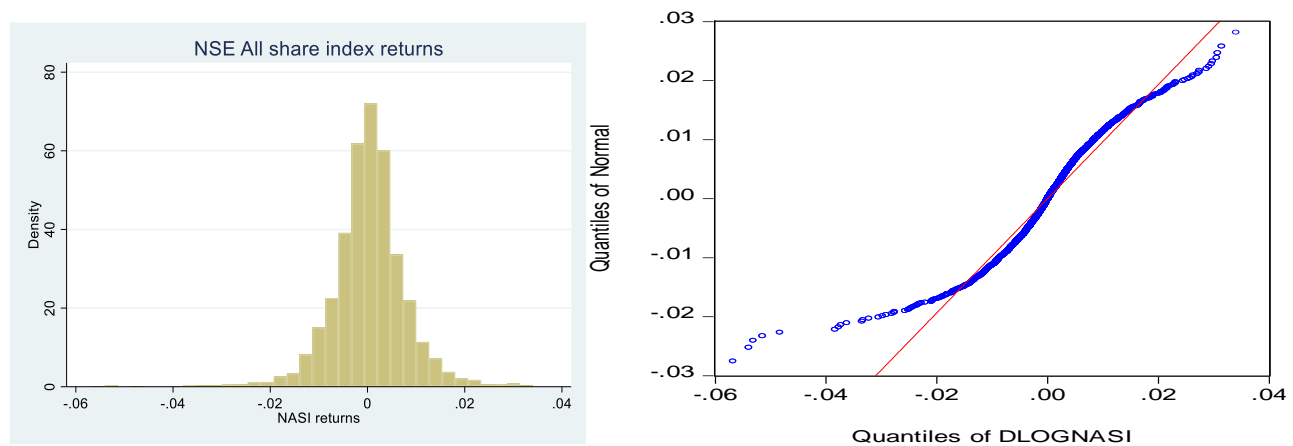


Figure 7.10 Histogram and Q-Q plot of the NSE All share index (NASI) returns

The histogram and q-q plot display characteristics of a leptokurtosis distribution of the NSE all share index daily returns. The return values on the Q-Q plot deviate at both ends from the line of normality, indicating a leptokurtic distribution. Also, the histogram shows a distribution that has a high peak – again pointing to leptokurtosis.

7.4 To assess weak-form Efficient Market Hypothesis for the Nairobi Securities Exchange (NSE)

This section presents the results of the serial correlation test, the variance ratio test, the linear unit root models and the non-linear unit root models. The results follow the methodology discussed in Chapter Five.

7.4.1 Serial correlation test Ljung-Box

This sub-section discusses the serial correlation results. To examine serial correlation of the five indices' daily returns, the Ljung-Box test for serial correlation was utilised. The Ljung-Box was used to test the overall correlation based on the lags. The test checked whether any group of a time series are different from zero. If p- value of the Q statistic is $< \alpha$ (0.05) or equal to 0.05 then reject H_0 , meaning the price changes are independent successive q time lags. If the p-value is $> \alpha$ (0.05), then it fails to reject H_0 .

The Autocorrelation Function (ACF) provides the unconditional relationship between the dependent variables. ACF checks how do past values correlate with current values and how those correlations relate to the lags, that is, indirect correlation. The Partial Autocorrelation Function (PACF) shows the partial or direct effect of the k^{th} lag of the y^{th} variable on the current value y_{t-k} . It differs from ACF, because it is partialing out or holding constant intervening lags.

The results from the Ljung-Box test displayed in Table 7.10, 7.11 and Table 7.12 indicate a degree of predictability of the returns in time $t-1$. The test was conducted under 36 lags for all the five indices' returns.

Table 7.11 Ljung-Box test of the NSE 20 share index and NSE 25 share index

Lags	NSE 20 share index				NSE 25 share index			
	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob
1	0.318	0.318	279.30	0.000	0.393	0.393	206.03	0.000
2	0.183	0.091	371.58	0.000	0.089	-0.077	216.63	0.000
3	0.083	0.001	390.66	0.000	0.060	0.063	221.52	0.000
4	0.065	0.027	402.31	0.000	0.035	-0.008	223.16	0.000
5	0.042	0.010	407.26	0.000	0.024	0.014	223.91	0.000
6	0.023	-0.002	408.69	0.000	0.029	0.017	225.06	0.000
7	0.013	-0.001	409.13	0.000	-0.010	-0.035	225.19	0.000
8	-0.005	-0.013	409.19	0.000	0.016	0.039	225.54	0.000
9	-0.003	-0.000	409.20	0.000	0.050	0.032	228.84	0.000
10	0.044	0.052	414.61	0.000	0.094	0.074	240.62	0.000
11	0.022	-0.004	416.00	0.000	0.052	-0.017	244.24	0.000
12	0.016	-0.001	416.72	0.000	-0.009	-0.031	244.35	0.000
13	0.014	0.006	417.23	0.000	-0.026	-0.016	245.24	0.000
14	0.021	0.013	418.47	0.000	-0.049	-0.045	248.47	0.000
15	-0.014	-0.031	419.00	0.000	-0.067	-0.037	254.44	0.000
16	0.005	0.013	419.06	0.000	-0.040	-0.001	256.57	0.000
17	0.021	0.023	420.31	0.000	0.003	0.030	256.58	0.000
18	0.041	0.031	424.88	0.000	0.044	0.042	259.15	0.000
19	0.033	0.011	427.98	0.000	0.046	0.013	262.06	0.000
20	0.025	0.002	429.73	0.000	0.014	-0.018	262.31	0.000
21	0.021	0.005	430.91	0.000	0.001	-0.002	262.31	0.000
22	0.012	-0.002	431.32	0.000	0.016	0.021	262.68	0.000
23	0.002	-0.009	431.33	0.000	0.015	0.005	262.98	0.000
24	-0.036	-0.045	435.02	0.000	-0.050	-0.062	266.44	0.000
25	-0.018	0.007	435.94	0.000	-0.089	-0.044	277.11	0.000
26	-0.025	-0.012	437.72	0.000	-0.073	-0.024	284.44	0.000
27	0.006	0.022	437.82	0.000	-0.018	0.017	284.89	0.000
28	0.018	0.017	438.75	0.000	0.012	0.005	285.08	0.000
29	0.004	-0.008	438.80	0.000	0.041	0.037	287.43	0.000
30	0.020	0.018	439.96	0.000	0.020	-0.006	288.00	0.000
31	0.018	0.006	440.82	0.000	-0.005	-0.010	288.04	0.000
32	0.024	0.010	442.43	0.000	0.041	0.057	290.37	0.000
33	0.033	0.021	445.49	0.000	0.005	-0.038	290.40	0.000
34	0.030	0.014	448.02	0.000	-0.052	-0.032	294.16	0.000
35	0.036	0.018	451.66	0.000	-0.069	-0.033	300.67	0.000
36	0.021	0.000	452.87	0.000	-0.005	0.049	300.70	0.000

Table 7.12 Ljung-Box test of the FTSE NSE 25 share index and FTSE NSE 15 share index

Lags	FTSE NSE 25 share index				FTSE NSE 15 share index			
	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob
1	0.340	0.340	320.26	0.000	0.375	0.375	389.43	0.000
2	0.074	-0.047	335.60	0.000	0.103	-0.044	418.55	0.000
3	0.016	0.006	336.32	0.000	0.028	0.005	420.72	0.000
4	0.006	0.002	336.43	0.000	0.016	0.009	421.42	0.000
5	0.006	0.003	336.52	0.000	0.020	0.014	422.54	0.000
6	-0.009	-0.014	336.75	0.000	0.010	-0.003	422.85	0.000
7	-0.016	-0.009	337.44	0.000	0.003	-0.001	422.87	0.000
8	0.005	0.015	337.50	0.000	0.001	0.001	422.88	0.000
9	0.033	0.030	340.53	0.000	0.015	0.016	423.47	0.000
10	0.049	0.031	347.24	0.000	0.031	0.023	426.14	0.000
11	0.018	-0.011	348.15	0.000	0.016	-0.005	426.86	0.000
12	-0.001	-0.005	348.15	0.000	0.002	-0.004	426.87	0.000
13	0.001	0.004	348.16	0.000	-0.004	-0.003	426.91	0.000
14	-0.016	-0.020	348.83	0.000	-0.013	-0.013	427.41	0.000
15	-0.036	-0.027	352.40	0.000	-0.035	-0.031	430.87	0.000
16	-0.044	-0.024	357.85	0.000	-0.040	-0.018	435.34	0.000
17	-0.020	0.005	358.98	0.000	-0.015	0.010	435.93	0.000
18	0.023	0.032	360.49	0.000	0.021	0.028	437.11	0.000
19	0.041	0.024	365.23	0.000	0.031	0.015	439.84	0.000
20	0.036	0.013	368.74	0.000	0.025	0.007	441.53	0.000
21	-0.004	-0.024	368.79	0.000	-0.009	-0.024	441.73	0.000
22	-0.018	-0.011	369.69	0.000	-0.013	-0.002	442.20	0.000
23	-0.017	-0.008	370.46	0.000	-0.019	-0.015	443.23	0.000
24	-0.029	-0.021	372.79	0.000	-0.026	-0.016	445.16	0.000
25	-0.045	-0.027	378.49	0.000	-0.034	-0.019	448.34	0.000
26	-0.059	-0.034	388.06	0.000	-0.045	-0.027	454.09	0.000
27	-0.022	0.011	389.43	0.000	-0.015	0.015	454.75	0.000
28	0.005	0.007	389.49	0.000	0.003	0.004	454.76	0.000
29	0.010	0.002	389.80	0.000	0.001	-0.005	454.77	0.000
30	0.022	0.017	391.16	0.000	0.015	0.018	455.43	0.000
31	-0.005	-0.021	391.24	0.000	-0.003	-0.017	455.45	0.000
32	0.026	0.038	393.15	0.000	0.016	0.026	456.17	0.000
33	0.040	0.024	397.55	0.000	0.047	0.042	462.48	0.000
34	0.019	0.003	398.53	0.000	0.035	0.005	465.84	0.000
35	-0.012	-0.015	398.96	0.000	-0.000	-0.017	465.84	0.000
36	0.018	0.036	399.90	0.000	0.016	0.028	466.60	0.000

Table 7.13 Ljung-Box test of the FTSE NASI share index

Lags	FTSE NSE 25 share index			
	AC	PAC	Q-Stat	Prob
1	0.344	0.344	326.93	0.000
2	0.074	-0.051	341.91	0.000
3	0.024	0.017	343.50	0.000
4	0.004	-0.007	343.54	0.000
5	-0.012	-0.013	343.94	0.000
6	-0.019	-0.011	344.91	0.000
7	-0.022	-0.013	346.27	0.000
8	0.005	0.020	346.34	0.000
9	0.034	0.030	349.59	0.000
10	0.047	0.028	355.77	0.000
11	0.006	-0.024	355.88	0.000
12	-0.011	-0.008	356.23	0.000
13	-0.005	0.002	356.30	0.000
14	-0.016	-0.016	357.02	0.000
15	-0.038	-0.028	360.97	0.000
16	-0.020	0.006	362.06	0.000
17	-0.009	-0.003	362.28	0.000
18	0.046	0.055	368.04	0.000
19	0.069	0.037	381.19	0.000
20	0.048	0.010	387.65	0.000
21	-0.006	-0.032	387.77	0.000
22	0.004	0.017	387.80	0.000
23	0.004	-0.001	387.85	0.000
24	-0.038	-0.041	391.91	0.000
25	-0.052	-0.022	399.44	0.000
26	-0.070	-0.049	413.21	0.000
27	-0.025	0.016	415.02	0.000
28	0.020	0.021	416.12	0.000
29	0.023	0.005	417.62	0.000
30	0.008	-0.004	417.79	0.000
31	-0.001	-0.003	417.79	0.000
32	0.059	0.067	427.47	0.000
33	0.039	0.000	431.79	0.000
34	0.001	-0.005	431.80	0.000
35	-0.011	-0.002	432.11	0.000
36	0.033	0.044	435.16	0.000

The Ljung-Box was conducted under 36 lags for all the five indices' daily returns. The results show that the P-values for all lags are below alpha (0.05), keeping in mind that the test is statistically significant at a 5% level. Therefore, the null hypothesis of "all autocorrelation up to 36 lags are zero" is rejected in favour of an alternative hypothesis, that there is autocorrelation. The correlation of the return in time t and time $t-1$ implies that the daily return series does not behave randomly, because there is a degree of predictability for future daily returns.

In addition, the AC function and the PAC function for all the five indices daily returns showed both positive and negative correlations. This provides further evidence of predictability in the returns.

The (AC) test for all indices are not equal to zero at all lags. Additionally, the NSE 20 index daily returns (AC) function indicated negative correlation for lag 8, 9, 15, 24, 25 and 26, while the remaining lags are positively correlated. The (PAC) function, in agreement, indicated that lags 6,7,8,9,11,12,15,22,23,24, 26, 29 are negatively correlated, and the remaining lags are positively correlated.

The NSE 25 share index daily returns, (AC) function indicated negative correlation for lag 7, 12, 13, 14, 15, 16, 24, 25, 26, 27, 31, 34, 35, and 36 while the remaining lags are positively correlated. The (PAC) function indicates lags 2, 4, 7, 15, 12, 13, 14, 15, 16, 24, 25, 26, 30, 31, 33, 34, 35 are negatively correlated and the remaining lags are positively correlated.

The FTSE NSE 25 share index (AC) function indicates negative correlation for lags 6, 7, 12, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, 27, 31, and 35, while the remaining lags are positively correlated. The (PAC) function indicates that lags 2, 6, 7, 11, 12, 14, 15, 16, 21, 22, 23, 24, 25, 26, 31, 35 are negatively correlated and the remaining lags are positively correlated.

The FTSE NSE 15 share index auto correlation (AC) function indicated negative correlations for lag 13, 14, 15, 16, 17, 21, 22, 23, 24, 25, 26, 27, 31, 35, while the remaining lags are positively correlated. The PAC function indicates that lags 2, 6, 7, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 27, 29 31, 35 are negatively correlated and the remaining lags are positively correlated.

The NASI daily returns (AC) function indicated negative correlation for lag 5, 6, 7, 12, 13, 14, 15, 16, 17, 24, 25, 26, 27, 31, and 35, while the remaining lags are positively correlated. The (PAC) function in agreement indicates lags 2, 4, 5, 6, 7, 11, 12, 14, 15, 17, 21, 23, 24, 25, 26, 30, 31, 34, and 35 are negatively correlated and the remaining lags are positively correlated.

7.4.2 Linear unit root tests

This sub-section discusses the results of the linear unit root tests implemented in this study. The linear unit root tests are the ADF, the PP, and the Zivot Andrews test as presented in the methodology chapter.

7.4.2.1 Augmented Dickey Fuller test

The augmented unit root tests for the random walk, intercept, and intercept and trend were implemented. These tests are used to examine the randomness of the NSE 20 index, the NSE 25 index, the FTSE NSE 25 share index, the FTSE NSE 15 share index, and the NASI daily return values. The series containing unit root is said to be non-stationary, and as a result would behave in a random fashion. This shows that the series is weak form efficient. The series that does not contain unit root is stationary, violates the random walk theory, and does not support weak form efficiency. The results of the ADF test are shown in Table 7.14 below.

Table 7.14 Augmented Dickey Fuller test

Augmented Dickey Fuller test with Intercept					
Index	Lags based on SIC	t Stat	Critical values (Tau values)	P-value	Decision
NSE 20	27	-27.9181	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
NSE 25	22	-21.6724	1% level -3.4350 5% level -2.8635 10% level -2.5678	0.0000	Reject null hypothesis
FTSE NSE 25	27	-36.8604	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
FTSE NSE 15	27	-35.3966	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
NASI	27	-36.6270	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
Augmented Dickey Fuller test with Intercept and trend					
Index	Lags based on SIC	t Stat	Critical values (Tau values)	P-value	Decision
NSE 20	27	-28.0486	1% level -3.9613 5% level -3.4114 10% level -3.1275	0.0000	Reject null hypothesis
NSE 25	22	-21.6639	1% level -3.9649 5% level -3.4131 10% level -3.1286	0.0000	Reject null hypothesis
FTSE NSE 25	27	-36.8733	1% level -3.9613 5% level -3.4114 10% level -3.1275	0.0000	Reject null hypothesis
FTSE NSE 15	27	-35.3966	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
NASI	27	-36.6456	1% level -3.9613 5% level -3.4114 10% level -3.1275	0.0000	Reject null hypothesis
Augmented Dickey Fuller test (Pure random walk)					
Index	Lags based on SIC	t Stat	Critical values (Tau values)	P-value	Decision
NSE 20	27	-27.8991	1% level -2.5658	0.0000	Reject null hypothesis

			5% level-1.9409 10% level-1.6166		
NSE 25	22	-21.6727	1% level -2.5667 5% level -1.9410 10% level-1.6165	0.0000	Reject null hypothesis
FTSE NSE 25	27	-36.8418	1% level -2.5657 5% level -1.9409 10% level-1.6166	0.0000	Reject null hypothesis
FTSE NSE 15	27	-35.3966	1% level -3.4325 5% level -2.8623 10% level-2.5672	0.0000	Reject null hypothesis
NASI	27	-36.6004	1% level -2.5658 5% level -1.9409 10% level-1.6166	0.0000	Reject null hypothesis

The NSE 20, the NSE 25, the FTSE NSE 25, FTSE NSE 15 and NASI indices' daily returns were subjected to the ADF test where the maximum lags for each index returns were selected based on Schwarz' Information Criteria (SIC) as indicated in Table 7.14 above.

The ADF test with intercept was applied, and pure random walk and ADF tests with both intercept and trend were applied to test the indices' daily return values. The results of both ADF tests indicate that the P-values for all lags are below alpha (0.05), keeping in mind that the test is statistically significant at a 5% level. This leads to the rejection of the null hypothesis in favour of the alternate hypothesis for all indices' returns. The tests imply that the series does not behave in a random manner, and thus does not support weak form efficiency.

7.4.2.2 The Phillips-Perron (PP) test

The non-parametric PP test was administered to further test the presence of a unit root in the series. In this study, only the PP test with intercept was applied. The results are indicated in Table 7.15 below.

Table 7.15 The Phillips-Perron (PP) Test

The Phillips-Perron (PP) Test with intercept				
Index	t Stat	Critical values (Tau values)	P-value	Decision
NSE 20	-39.07533	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
NSE 25	-23.90631	1% level -3.4350 5% level -2.8635 10% level -2.5678	0.0000	Reject null hypothesis
FTSE NSE 25	-36.52516	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
FTSE NSE 15	-35.17898	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
NASI	-36.23317	1% level -3.4325 5% level -2.8623 10% level -2.5672	0.0000	Reject null hypothesis
The Phillips-Perron (PP) Test with intercept and trend				
Index	t Stat	Critical values (Tau values)	P-value	Decision
NSE 20	-38.94847	1% level-3.9613 5% level-3.4114 10% level-3.1275	0.0000	Reject null hypothesis
NSE 25	-36.56236	1% level-3.9613 5% level-3.4114 10% level-3.1275	0.0000	Reject null hypothesis
FTSE NSE 25	-23.89733	1% level-3.9649 5% level-3.4131 10% level-3.1286	0.0000	Reject null hypothesis
FTSE NSE 15	-35.19785	1% level-3.9613 5% level-3.4114 10% level-3.1275	0.0000	Reject null hypothesis
NASI	-36.23061	1% level-3.9613 5% level-3.4114 10% level-3.1275	0.0000	Reject null hypothesis
The Phillips-Perron (PP) test (pure random walk)				
Index	t Stat	Critical	P-value	Decision

		values (Tau values)		
NSE 20	-39.08708	1% level-2.5658 5% level-1.9409 10% level-1.6166	0.0000	Reject null hypothesis
NSE 25	-23.91064	1% level-2.5667 5% level-1.9410 10% level-1.6165	0.0000	Reject null hypothesis
FTSE NSE 25	-36.52275	1% level-2.5657 5% level-1.9409 10% level-1.6166	0.0000	Reject null hypothesis
FTSE NSE 15	-35.23630	1% level-2.5657 5% level-1.9409 10% level-1.6166	0.0000	Reject null hypothesis
NASI	-36.23674	1% level-2.5658 5% level-1.9409 10% level-1.6166	0.0000	Reject null hypothesis

The Phillips-Perron (PP) test with intercept, pure random walk and intercept with trend were further applied to the NSE 20, the NSE 25, the FTSE NSE 25, FTSE NSE 15 and the NSE all share indices daily returns. The maximum lag was 8 for the NSE20 and NASI and 7 for the rest of the indices. The maximum lags were selected based on Newey-West bandwidth. The P-values obtained for all indices' returns are zero, which is below significance level of 0.05. Consequently, the null hypothesis is rejected in favour of the alternate hypothesis.

7.4.2.3 Zivot-Andrews test

The Zivot-Andrews test that considers structural break within the series was implemented, and the results are shown in Table 7.15 below:

Table 7.16 The Zivot Andrews test with intercept

Index	Zivot Andrews test statistic	Critical values (Tau values)	P-value	Decision
NSE 20	-28.1635	1% level -5.34 5% level -4.93 10% level -4.58	0.0071	Reject null hypothesis
NSE 25	-17.6290	1% level -5.34 5% level -4.93 10% level -4.58	0.0189	Reject null hypothesis
FTSE NSE 25	-30.8032	1% level -5.34 5% level -4.93 10% level -4.58	0.0148	Reject null hypothesis
FTSE NSE 15	-31.7552	1% level -5.34 5% level -4.93 10% level -4.58	0.0044	Reject null hypothesis
NASI	-31.7552	1% level -5.34 5% level -4.93 10% level -4.58	0.0044	Reject null hypothesis

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process

The p-values, which are calculated from a standard t-distribution. Are close to zero, below alpha (0.05). the test is statistically significant at 5% level, implying that the null hypothesis $H_0: \alpha = 0$ (series contains a unit root with a drift hence is non- stationary) is rejected in favour of the alternate hypothesis $H_a: \alpha < 0$ (series has one –time break occurring at a known time and is a trend stationary). Thus, the series is stationary and does not behave in a random manner

7.4.3 Runs test

This sub-section presents the non-parametric runs test results. The test was used to analyse whether the returns follow random walk. The results are shown in Table 7.17.

Table 7.17 Runs test

Share index		Median	Mean	Mode
NSE 20	Test value	.000	-.00020	.000
	Cases < Test value	1377	1356	1445
	Cases > = Test value	1377	1398	1309
	Total cases	2754	2754	2754
	Number of runs	1146	1150	1166
	Z	-8.843	-8.681	-7.972
	Asymp. Sig. (2-tailed)	.000	.000	.000
NSE 25	Test value	.000	-.00015	.016 ^b
	Cases < Test value	666	647	1299
	Cases > = Test value	666	685	33
	Total cases	1332	1332	1332
	Number of runs	524	524	55
	Z	-7.839	-7.816	-5.921
	Asymp. Sig. (2-tailed)	.000	.000	.000
FTSE NSE 25	Test value	.000	.00027	.000
	Cases < Test value	1382	1354	1300
	Cases > = Test value	1382	1410	1464
	Total cases	2764	2764	2764
	Number of runs	1027	1035	1043

	Z	-13.545	-13.225	-12.796
	Asymp. Sig. (2-tailed)	.000	.000	.000
FTSE NSE 15	Test value	.000	.00024	.000
	Cases < Test value	1382	1369	1313
	Cases > = Test value	1382	1395	1451
	Total cases	2764	2764	2764
	Number of runs	1027	1027	1047
	Z	-13.545	-13.542	-12.685
	Asymp. Sig. (2-tailed)	.000	.000	.000
NASI	Test value	.000	.00027	.000
	Cases < Test value	1377	1366	1293
	Cases > = Test value	1378	1389	1462
	Total cases	2755	2755	2755
	Number of runs	1081	1075	1057
	Z	-11.338	-11.564	-12.101
	Asymp. Sig. (2-tailed)	.000	.000	.000

- Nse 25 -There are multiple modes. The mode with the largest data value is used

The two tailed p-value obtained under the mean, median and mode for the NSE 20 share index daily returns series, the NSE 25 daily return series, FTSE NSE 25 daily return series, FTSE NSE 15 daily return series and NASI daily return series show that the values are less than alpha at 5% significance. As a result, the null hypothesis that the series is random is rejected in favour of the alternate hypothesis; the series is not random. Likewise, the absolute value of the Z statistics of the of the runs test under the mean, median and mode is greater than 1.96, indicating non-randomness. Also, the Z statistics values are all negative, indicating that the observed runs are less than the expected runs – implying a positive

correlation. Therefore, the series does not behave in a random fashion.

7.4.4 Variance ratio

The variance ratio test that compares variance ratio over time was applied under the heteroskedasticity assumption. The results are presented in Table 7.17 below.

Table 7.18 Variance ratio test (under heteroskedasticity assumptions)

Share Index	Joint test				
NSE 20	Joint test	Value	Df	Probability	
	Max z (at period 2)*	12.6252	2753	0.0000	
	Individual Tests				
	Period	Var. ratio	Std. error	z-Statistic	Probability
	2	0.5995	0.0317	-12.6252	0.0000
	4	0.3433	0.0538	-12.1914	0.0000
	8	0.1844	0.0770	-10.5806	0.0000
	16	0.0914	0.1058	-8.5800	0.0000
NSE 25	Joint test				
	Joint test	Value	Df	Probability	
	Max z (at period 4)*	7.1475	1331	0.0000	
	Individual Tests				
	Period	Var. ratio	Std. error	z-Statistic	Probability
	2	0.7507	0.0444	-5.6040	0.0000
	4	0.3984	0.0841	-7.1475	0.0000
	8	0.2041	0.1309	-6.0785	0.0000
16	0.1089	0.1848	-4.8193	0.0000	
FTSE NSE 25	Joint test				
	Joint tests	Value	Df	Probability	
	Max z (at period 4)*	10.8656	2763	0.0000	
	Individual tests				
	Period	Var. Ratio	Std. Error	z-Statistic	Probability
	2	0.7018	0.0311	-9.5705	0.0000
	4	0.3771	0.0573	-10.8656	0.0000
	8	0.1888	0.0860	-9.4297	0.0000
16	0.0992	0.1196	-7.5301	0.0000	
FTSE NSE 15	Joint test				
	Joint tests	Value	Df	Probability	

	Max z (at period 4)*	10.9591	2763	0.0000	
	Individual tests				
	Period	Var. Ratio	Std. Error	z-Statistic	Probability
	2	0.7184	0.0298	-9.4286	0.0000
	4	0.3943	0.0552	-10.9591	0.0000
	8	0.2000	0.0838	-9.5413	0.0000
	16	0.1042	0.1165	-7.6824	0.0000
	Joint test				
	Joint tests	Value	Df	Probability	
	Max z (at period 4)*	10.5540	2754	0.0000	
	Individual tests				
	Period	Var. Ratio	Std. Error	z-Statistic	Probability
	2	0.7066	0.0318	-9.2017	0.0000
	4	0.3803	0.0587	-10.5540	0.0000
	8	0.1899	0.0882	-9.1803	0.0000
NASI	16	0.0974	0.1226	-7.3574	0.0000
*Probability approximation using studentised maximum modulus with parameter value 4 and infinite degrees of freedom					

The variance test ratio test results under the heteroskedasticity assumption are shown in Table 7.18. The results indicate that the Chow-Denning maximum $I z I$ statistic of the NSE 20 share index daily returns series associated with period 2 joint test of 12.62524. The results also indicate the Chow-Denning maximum $I z I$ statistic of the NSE 25 daily return series, FTSE NSE 25 daily return series, FTSE NSE 15 and NASI daily return series associated with period 4 joint test of 7.147567, 10.86564, 10.95918, 10.55407 respectively. The p-values associated with the Chow-Denning maximum $I z I$ statistic are approximated using studentised maximum modulus with parameter value 4 and infinite degrees of freedom. In addition, the p-values associated with the test are below alpha of 0.05, and thus the test is statistically significant at 5%, Consequently the null hypothesis of random walk is rejected. In addition, the p-values for individual periods (2, 4, 8, and 16) are zero, which is further evidence for rejecting the null hypothesis under heteroskedasticity. The variance ratio test that compares variance ratio over time was applied under the homoskedasticity assumption; the results are presented in Table 7.18.

Table 7.19 Variance ratio test (under homoskedasticity assumptions)

Share Index	Joint test				
	Joint test	Value	Df	Probability	
	Max z (at period 2)*	21.0120	2753	0.0000	
	Wald (Chi-Square)	448.9434	4	0.0000	
	Individual tests				
	Period	Var. ratio	Std. error	z-Statistic	Probability
	2	0.5995	0.0190	-21.0120	0.0000
	4	0.3433	0.0356	-18.4149	0.0000
	8	0.1844	0.0563	-14.4653	0.0000
16	0.0914	0.0838	-10.8295	0.0000	
NSE 25	Joint test				
	Joint test	Value	Df	Probability	
	Max z (at period 4)*	11.7307	1331	0.0000	
	Wald (Chi-Square)	138.3799	4	0.0000	
	Individual Tests				
	Period	Var. ratio	Std. error	z-Statistic	Probability
	2	0.7507	0.0274	-9.0923	0.0000
	4	0.3984	0.0512	-11.7307	0.0000
8	0.2041	0.0810	-9.8160	0.0000	
16	0.1089	0.1206	-7.3850	0.0000	
FTSE NSE 25	Joint test				
	Joint Tests	Value	Df	Probability	
	Max z (at period 4)*	17.5005	2763	0.0000	
	Wald (Chi-Square)	313.9396	4	0.0000	
	Individual tests				
	Period	Var. ratio	Std. error	z-Statistic	Probability
	2	0.7018	0.0190	-15.6744	0.0000
	4	0.3771	0.0355	-17.5005	0.0000
8	0.1888	0.0562	-14.4132	0.0000	
16	0.0992	0.0837	-10.7568	0.0000	
FTSE NSE 15	Joint test				
	Joint Tests	Value	Df	Probability	
	Max z (at period 4)*	17.0160	2763	0.0000	
	Wald (Chi-Square)	293.3218	4	0.0000	
	Individual tests				
	Period	Var. ratio	Std. error	z-Statistic	Probability
	2	0.7184	0.0190	-14.8004	0.0000
	4	0.3943	0.0355	-17.0160	0.0000
8	0.2000	0.0562	-14.2157	0.0000	
16	0.1042	0.0837	-10.6965	0.0000	
NASI	Joint test				
	Joint tests	Value	Df	Probability	
	Max z (at period 4)*	17.3815	2754	0.0000	
	Wald (Chi-Square)	308.1841	4	0.0000	
	Individual tests				
	Period	Var. ratio	Std. error	z-Statistic	Probability
	2	0.7066	0.0190	-15.3960	0.0000

	4	0.3803	0.0356	-17.3815	0.0000
	8	0.189904	0.0563	-14.3719	0.0000
	16	0.097433	0.0838	-10.7607	0.0000
*Probability approximation using studentized maximum modulus with parameter value 4 and infinite degrees of freedom					

Table 7.19 indicates the results of the variance ratio test under the homoskedasticity assumption. The results indicate the Chow-Denning maximum I z I statistic of the NSE 20 share index daily returns series associated with period 2 joint test value of 21.01205. The results also indicate the Chow-Denning maximum I z I statistic of the NSE 25 daily return series, FTSE NSE 25 daily return series, FTSE NSE 15 daily return series and NASI daily return series associated with period 4 joint test of 11.73079, 17.50051, 10.95918 and 17.38158 respectively. The p-values associated with the Chow-Denning maximum I z I statistic are approximated using studentised maximum modulus with parameter value 4 and infinite degrees of freedom. In addition, the p-values associated with the test are below alpha of 0.05, and therefore the test is statistically significant at 5%. Consequently, the null hypothesis of random walk is rejected.

7.4.5 Non-linear unit root test

This sub-section presents non-linear unit root tests conducted using the two–regime and three-regime threshold autoregressive (TAR) models. Following Hansen (2000), in order to perform both two regime and three-regime threshold autoregressive tests, the number of observations T were obtained by truncating 15% off the largest and smallest values. As a result, 70% of the values were used to estimate the threshold parameter (Phiri,2015). Eleven lags of the dependent variable were used as threshold regressor and a constant as a non-varying regressor. The Eviews software selected the superior lag specification for the self-exciting TAR model. Selection of one threshold led to two regimes, while selection of two thresholds led to three-regimes. It must be noted that the threshold level was subjective. One of the goals of threshold estimation is to find the value (or values) of the data series that trigger(s) the regime change.

Table 7.20 Two-regime threshold autoregression (TAR) test

TAR		NSE 20	NSE 25	FTSE NSE 25	FTSE NSE 15	NASI
Two regime	Threshold value (T)	0.00508*	-0.0055*	0.0071*	0.0074*	0.0066*
	F-stat	6.2834*	6.3725*	6.0330* 4.6653*	6.3136* 3.6789*	4.4418*
	Critical value	27.03**	27.03**	27.03** 29.24**	27.03** 29.24**	27.03**

* Significant at the 0.05 level ** Bai-Perron critical values

Table 7.20 presents the results obtained from the two regime TAR model. Values that trigger the regime change under two regime threshold autoregressive nonlinear test for the NSE 20, NSE 25, FTSE NSE 25, FTSE NSE 15 and the NASI daily return series were 0.005084991, -0.0055608751, 0.0071086879, 0.0074176789 and 0.006674766 respectively. The null hypothesis for all the four indices indicated in Table 6.19 above were rejected based on the fact that the modified F statistic’s absolute value was lower than the critical values of the test. This confirms stationarity.

Table 7.21 Three regime threshold autoregression (TAR) test

TAR		NSE 20	NSE 25	FTSE NSE 25	FTSE NSE 15	NASI
Three regime	Threshold value (τ)	0.0013*	0.0010*	-0.0016*	-0.0008*	0.0012*
		0.0050*	0.0056*	0.0065*	0.0076*	0.0046*
	$W_{\tau}(\tau)$	10.3144	18.4453	10.4999	13.7803	19.4087
	$LM_{\tau}(\tau)$	7.3611	1.0306	1.6298	1.9073	0.6468
	Critical value	27.03**	27.03**	27.03**	27.03**	27.03**
			29.24**	29.24**	29.24**	29.24**
			30.45**			

* Significant at the 0.05 level ** Bai – Perron critical values

Table 7.21 presents results from the three-regime TAR model. The threshold estimation values depicted under the three-regime threshold autoregressive nonlinear unit root test for NSE 20 daily return series were 0.0013732909 and 0.005084991. The threshold values for the NSE 25 daily return series were 0.00100708 and 0.0056896209. The FTSE NSE 25 daily index return series threshold values were indicated as -0.001644135 and 0.0065731999 series. The FTSE NSE 15 daily index return series indicated threshold values of -0.00089216231 and 0.0076165199. The threshold values for the NASI daily return series were 0.001269817 and 0.004683494. The null hypothesis for all the four indices shown in Table 7.21 is rejected in favour of the alternate hypothesis. This is based on the fact that the Wald and Lagrange Multiplier test statistic absolute values are lower than the Bai-Perron critical values. This suggests stationarity. If the resulting test statistics are smaller in value in comparison to their computed critical values, the time series is stationary (Phiri, 2015).

7.5 To determine whether the current NSE stock indices are representative for the Kenyan capital market

To determine whether the current NSE stock indices are representative for the Kenyan capital market, the Vector Autoregressive Model (VAR) was utilised to analyse the causality interaction between the NSE all share index and the other NSE indices.

7.5.1 Pairwise Granger causality test

To achieve the second objective, the Pairwise Granger causality test was utilised. The optimal lag length of 7 was estimated by the Akaike Information Criteria (AIC), and the results are displayed in Table 7.20.

Table 7.22 Pairwise Granger causality tests

Lags: 7

Null Hypothesis:	Obs	F-Statistic	Prob.
FTSENSE15INDEX does not Granger Cause NASI	2748	3.2124	0.0022
NASI does not Granger Cause FTSENSE15INDEX		56.4224	9.E-76
FTSENSE25INDEX does not Granger Cause NASI	2748	4.3242	9.E-05
NASI does not Granger Cause FTSENSE25INDEX		63.8140	2.E-85
NSE20INDEX does not Granger Cause NASI	2747	80.9619	4E-107
NASI does not Granger Cause NSE20INDEX		4.3977	7.E-05
NSE25INDEX does not Granger Cause NASI	1325	1.7661	0.0903
NASI does not Granger Cause NSE25INDEX		0.7568	0.6238

According to the results shown in Table 7. 22, a bidirectional causality between FTSE NSE 15 index returns and NASI returns was found. In both cases, the p-value is below 0.05, therefore rejecting the null hypothesis at a 5% significance level. The FTSE NSE 15 index returns Granger-cause the NASI returns and, likewise, the NASI returns Granger-cause the FTSE NSE 15 index returns.

Table 7.21 indicates bidirectional causality between the FTSE NSE 25 index daily returns and the NASI. The FTSE NSE 25 returns Granger causes NASI returns and the NASI returns series Granger causes the FTSE NSE 25 returns. Based on the p-values, the null hypothesis is rejected.

In addition, bidirectional Granger causality was also realised between NSE 20 index returns and NSE all share index returns (NASI). Both p-values are below 0.05, the test being significant at 5% level. The null hypothesis is therefore rejected. The NSE 20 index returns Granger cause the NSE all share index returns (NASI), and the NASI returns Granger cause the NSE 20 index returns.

Finally, no causality is found between the NSE 25 index returns and NASI returns at the p-value of 0.0903. Therefore, the null hypothesis is not rejected. The NASI returns do not Granger cause the NSE 25 index returns and at the p-value of 0.6238 – the reason for not accepting the null hypothesis, indicating no causality between the NASI and the NSE 25 index returns.

Based on the results indicated in Table 7.21, it can be concluded that the NSE 20 share index, the FTSE NSE 15 share index, the FTSE NSE 25 share index are adequate representatives of the Kenyan capital markets. The three indices can be utilised to introduce index funds. The NSE 25 share index, on the other hand, is not an adequate representative of the Kenyan capital markets, and as a result cannot be utilised in the introduction of index funds.

CHAPTER 8

Discussion and interpretation of results

8.1 Introduction

This chapter presents a discussion and interpretation of the results of the study. The aim of the study was to assess weak-form Efficient Market Hypothesis for the Nairobi Securities Exchange (NSE) and to determine whether the current NSE stock indices are representative of the Kenyan capital market. To achieve these objectives, the daily closing prices for the NSE bourse indices were collected. The daily return values computed from the daily closing prices of the indices were then analysed using different time series tests. Empirical results were obtained, and are reported in Chapter Six of this study. This chapter discusses the results from the perspective of the conceptual framework presented in Chapter three.

Based on the results, the NSE indices were found to be stationary. Therefore, the NSE indices violates the weak form Efficient Market Hypothesis (EMH). However, three of the indices were found to be market representative. These results have implications for the introduction of index funds. Similar to the NSE, African Exchange Markets (AEMs) have been found to violate EMH with the exception of a few. This is because of some AEMs are characterised by factors that do not favour EMH. These characteristics include low listings found in AEMs, low capitalisation, thin trading and macro-economic factors. To enhance informational efficiency, the AEMs including the NSE must put policies in place that aim to eradicate hindrances to informational efficiency.

In light of this, Section 8.2 presents descriptive statistics, Section 8.3 provides a discussion on results of assessing the weak form EMH of the Nairobi Stock Exchange (NSE). Section 8.4 explains and interprets the results on determining whether the current NSE stock indices are market representative. Section 8.5 gives a summary of empirical results. Section 8.6 presents the suitability of introducing index funds in Kenya. Section 8.7 discusses further on the weak form inefficiency of the NSE. Finally, Section 8.8 gives a discussion and presents the framework for the introduction of index funds.

8.2 Descriptive statistics

The descriptive statistics of the daily closing prices for the NSE 20 share index, the NSE 25 share index, the FTSE Kenya 15 share index, the FTSE 25 share index and the NSE all share index. The statistics covers daily sample period of between January 4, 2010, and December 31, 2020, and indicates non-

stationarity. This is because of the constant mean displayed through the line graphs of the daily index prices for each index. There is an indication of a downward trend for all the five indices. On the other hand, the line graphs of the daily return series for all the five indices (the NSE 20 share index, the NSE 25 share index, the FTSE Kenya 15 share index, the FTSE 25 share index and the NSE all share index) suggest stationarity, because of a constant mean after differencing. In addition, the return series plot has high fluctuations around the mean indicating, high volatility.

Leptokurtosis was indicated by the high peaks of the histograms in all the return series. The fat tails and the deviation from the line of normality evidenced by both ends of the Q-Q plots for all the indices were further indications of leptokurtosis. In addition, the values of the means, skewness and kurtosis of all the return series are not equal to zero a suggestion of non-normality. The kurtosis values of all the return series were found to be higher than 3, a further indication of non-normality. The Jarque-Bera tests and Shapiro-Wilk tests of normality had p-values of less than alpha 0.05, hence rejecting the null hypothesis of normality. Consequently, it is concluded that the NSE indices' data for the period January 4, 2010, and December 31, 2020, deviates from normality.

While the daily closing index prices of all the indices indicated non-stationarity in the line graphs, the return series line graphs of all the indices indicated stationarity, non-normality, and high volatility – suggesting non-linearity of the data. The time series data further shows skewness and kurtosis; this may be caused by the volatility in the NSE where periods of instability are followed by periods of stability. The volatility experienced in the time series could also be the result of underlying nonlinear trends in the data generating process (DGP).

Abakah et al. (2018) note that data generating process (DGP) in African stock markets and other emerging stock markets is non-linear. The nonlinearity of the DGP is caused by factors that tend to be specific to the African Equity Markets (AEMs) and other emerging markets. These factors include structural changes, changes in regulations, characteristics of market microstructures, low liquidity, unreliable and unqualified information, thin trading, price limits and market volatility. Finally, the non-normality indicated in this study may also be caused by dependency in returns that was evidenced by the serial correlation test.

The asymmetric behaviour of the data as evidenced by the descriptive statistics emphasised the application of non-linear unit root models alongside linear unit root models. The asymmetric adjustments

in the unit root tests procedure were done through the application of Enders and Granger (1998) and Bec et al. (2004) capitalis and three regime threshold autoregressive tests respectively. Enders and Granger (1998) and Caner and Hansen (2001) demonstrated that the conventional linear unit root tests have little power in testing for unit roots when the underlying data generating process is found to be non-linear. justifying the use of non-linear unit root tests.

8.3 Assessing weak form Efficient Market Hypothesis of the Nairobi Securities Exchange (NSE)

To achieve the first objective of the study, daily returns of five indices were analysed. The indices were the NSE 20 share index, the NSE 25 share index, the FTSE NSE Kenya 15 share index, the FTSE NSE 25 share index and the NASI. The following tests were implemented for the assessment: the Serial correlation Ljung- Box, linear unit root tests, the Runs test, the Variance Ratio test and the non-linear unit root test, that is the TAR.

8.3.1 Serial correlation

The Ljung-Box test for serial correlation was used to test the serial correlation of the price changes. The test was used to test predictability of the returns in time $t-1$, under 36 lags for the five indices. The null hypothesis of non-stationarity for all the stock indices was rejected. Negative and positive correlations were present in the time series returns of all the indices. The cause of the presence of serial correlations in the returns of all the indices could be non-synchronous trading and thin trading within the Bourse. This is common in African markets, where the majority of the stocks scarcely trade or only trade for a few hours during business hours (Abakah et al., 2018).

8.3.2 Unit root tests

8.3.2.1 Linear unit root tests

Linear unit root tests were applied in testing for the weak form efficiency of the NSE Bourse. The linear unit root tests that were utilised are the Augmented Dickey Fuller test (ADF), the Phillips-Perron test (PP), and the Zivot Andrews test that considers one structural break in the data.

The Augmented Dickey Fuller tests for both the intercept, pure random walk and intercept and trend were applied. The null hypothesis of non-stationarity was rejected. The results indicated the absence of unit roots in all the five indices return series, and thus suggest stationarity for all the return series of the five indices. The Phillips-Perron test with intercept, pure random walk and with intercept and trend was applied, and results were similar – leading to the rejection of the null hypothesis. Zivot Andrews's test

that considers structural breaks was used to test the null hypothesis of daily returns with a unit root with a structural break in the intercept. Structural breaks were found, and the null hypothesis was rejected in favour of the alternate, thus the stationarity of the five indices.

8.3.2.2 Non-linear unit root test

The non-linear unit root test threshold autoregression (TAR) was used to test the stationarity of the data. The capitalis threshold autoregressive by Enders and Granger (1998) and the three-regime threshold autoregressive by Bec et al. (2004) unit root tests were implemented. The linear unit root test results were confirmed. The null hypothesis was rejected in favour of the alternative hypothesis, which is threshold stationarity of the five share indices. The non-linear unit root test thus further confirmed the stationarity of the data.

The results presented in Tables 6.13, 6.14, 6.15, 6.16, 6.19 and 6.20 conclude that unit root is absent in all the five indices return series. This indicates that the stocks indices for the NSE are stationary, non-random and hence weak form inefficient.

8.3.3 Runs test

The non-parametric runs test was applied. The Z statistic of the runs test were greater than 1.96, indicating non-randomness. Also, the statistic values were all negative, suggesting that the observed runs are less than the expected runs. This implies a positive correlation, and thus the series does not behave in a random manner. The p-values likewise demonstrated the non-randomness of the stock indices. Consequently, the runs test further validated results from previous tests that the stock indices do not follow random walk.

8.3.4 Variance ratio test

The variance ratio test advanced by Lo and MacKinlay (1988) that compares variance ratios over time was applied. The test was applied under both the heteroskedasticity assumption and the homoskedasticity assumption. The null hypothesis of the series being a random walk under both assumptions were tested and rejected under both circumstances. The results indicated stationarity, because the null hypothesis was rejected in favour of the alternate hypothesis.

8.4 Determining whether the current NSE stock indices are representative for the Kenyan capital market

The second objective was achieved through the Pairwise Granger causality test. The results indicated bidirectional causality between FTSE NSE 15 index and the NASI. Bidirectional causality was also found between the FTSE NSE 25 and the NASI, as well as between the NSE 20 and NASI. There was no causality found between NSE 25 and NASI. Therefore, the results indicated that the FTSE NSE 15, FTSE NSE 25 and the NSE 20 stock indices are representative of the Kenyan capital markets. Consequently, the three indices can be utilised for the introduction of index funds in Kenya. The NSE 25 was, however, found not to be representative of the Kenyan capital markets, and as a result, it is not suitable for the introduction of index funds in the NSE.

8.5 Summary of empirical results

This paper sought to investigate the weak form Efficient Market Hypothesis for the Kenyan Nairobi Securities Exchange (NSE). The daily closing stock prices for five generalised indices (the NSE 20 share index, the NSE 25 share index, the FTSE Kenya 15 share index, the FTSE 25 share index and the NASI) that covered sample period of between January 4, 2010, and December 31, 2020, were analysed. Descriptive statistics showed non-normality of the data. This finding is in line with Ntim et al. (2011) who found that African nationwide stock price indices tend to be non-normally distributed due to the inefficiencies that characterise most African Exchange Markets (AEMs). This is an indication of a non-linear data generating process (DGP).

The serial correlation test rejected the null hypothesis that stated that there is an absence of serial correlation between price changes over successive q-time lags hence stationarity. In addition, the linear unit root tests that were applied rejected the null hypothesis in favour of the alternate hypothesis that stated that there is no unit root present in the series. Enders and Granger (1998) and Caner and Hansen (2001) showed that the conventional linear unit root tests have low power in testing for unit roots when the underlying DGP is found to be non-linear. For this reason, the non-linear unit root test TAR was implemented. The nonlinear tests (the two regime and three-regime threshold autoregression (TAR)) provided further evidence that inferred stationarity. The TAR model, which accounts for non-linearity in the testing procedure, rejected the null hypothesis. The tests do not support threshold non-stationarity, further confirming the stationarity of the five-time series. The runs and the variance ratio tests yielded the same results in terms of the non-randomness of the data.

The second objective of this paper was to determine whether the current NSE stock indices are representative for the Kenyan capital market. This study followed Njuguna (2014) who purports that the NASI reflected the entire change in stock prices for all companies listed at the exchange, and is consequently a good reflector of market performance. Based on this, the pairwise Granger causality model was used to determine the representativeness of the indices. The results clearly showed that three indices (the FTSE NSE 15, the FTSE NSE 25, and the NSE 20 index) are representative of the Kenyan capital markets. In a similar study, Njuguna (2014) found that the NSE 20 had a strong positive correlation with market performance and, as a result, is representative of the capital markets. A similar study, however, yielded contradictory results as Mogambi (2017) could not confirm the market representativeness of the NSE 20 share index. These results received criticism because the model used could not be proven to be statistically significant in predicting the market representativeness of the NSE 20 share index.

8.5.1 Conclusion

In conclusion, the evidence from the battery of tests leads one conclude that the Nairobi Securities Exchange (NSE) indices do not follow a random walk. The NSE is stationary, and therefore is not weak form efficient. Consequently, the NSE does not reflect all historical information. Prices constitute only limited information that is reflected in the stock prices. The NSE is not weak form efficient, and this violates EMH. These results confirm Njuguna's (2016) results where the NSE was found weak form inefficient. Secondly, based on the pairwise Granger causality test that was used to determine the representativeness of the indices, three indices (the FTSE NSE 15, the FTSE NSE 25, and the NSE 20 index) were found to be representative of the Kenyan capital markets.

8.6 Suitability of the introduction of index funds in Kenya

The empirical results clearly indicate that the NSE is weak form inefficient and, as a result, index funds cannot be introduced in the NSE, because the Bourse violates the Efficient Market Hypothesis (EMH). To reiterate,

“The Efficient Market Hypothesis holds the view that in an efficient market, new information is processed and evaluated as it arrives and prices instantaneously adjust to new and correct levels. Consequently, an investor cannot consistently beat the market and earn excess returns by undertaking fundamental analysis or technical analysis” (Kevin, 2009:124; Block & Hirt, 2002:416).

Index funds require an efficient market where active managers are continually able to beat the market (Nyamute et al., 2013; Seth & Sharma, 2015; Chitenderu et al., 2014; Dragota & Tilica, 2013).

Index funds require market representative indices to be introduced to the capital markets. To emphasise the need of market representative indices, this proposed study adapted a definition of index funds proposed by a number of scholars (Brown & Reilly, 2009:545; Saunders & Cornett, 2009:495; Bodie et al., 2010:235). The definition proposed by these scholars' state that index funds, also known as passive funds, are capital markets' financial instrument that match or replicate the performance of a stock index. Therefore, fund managers buy securities that are the exact composition of a representative stock index or invest in a sample of a stock that mimics the stock index. The funds require a market representative index to track (Akama & Jagongo, 2013; Brown & Reilly, 2009; Kevin, 2009; Nagarajan & Jayabal, 2011, Cornett & Saunders, 2009). From the above discussions, it is demonstrated that the FTSE NSE 15, the FTSE NSE 25, and the NSE 20 index are representative of the Kenyan capital markets. As a result, index funds can be introduced in the NSE using the three indices that are market representative.

8.7 Discussion on weak form inefficiency of the NSE

The results of this study concerning EMH confirm the findings of the majority of studies conducted in African developing markets, where the markets were found to be mostly inefficient, apart from an exceptional few. It has been noted that there are due to different methodologies used in different time periods (Mlambo & Biekpe 2007). Regardless of the conflicting results, the majority of the African equity exchange markets have been found to be weak form inefficient (Smith, 2008; Adelegan 2009).

Similar test for the EMH used in this study have been utilised in other studies in Kenya and the East African region, and the results are the same. A Kenyan stock exchange empirical study by Njuguna (2016) had similar findings. The author used the same tests as those used in this study. The serial correlation test, ADF and PP unit tests and the variance ratio tests were used in the study, and the Kenyan NSE was found not to be weak form efficient. The Kenyan neighbouring exchange, the Tanzanian Stock Exchange, was examined by Njuguna (2016) and the weekly data for the period November 2006 to August 2015 was taken into account. It was found that the Tanzanian Stock Exchange (TSE) violated the EMH when the serial correlation test, the ADF, PP and the Runs tests were applied. The market was, however, found to be weak form efficient when the variance ratio test was applied in the analysis. The

mixed results of investigations of the weak form efficiency have been noted by past studies. Therefore, using different methodologies can result in mixed results, as mentioned earlier. Katabi and Raphael (2018) tested the Dar es Salaam stock exchange using the Ljung-Box test, Unit root tests, the Runs test and the variance ratio test, and found that the stock exchange did not follow random walk and, as a result, was weak form inefficient.

Other studies on the African continent indicate mostly weak form efficiency results. Dell-Amore (2004), while noting that there was scant evidence on weak and semi-strong efficiency in developing markets, point out that the Nigerian stock market was not weak form efficient. Further investigation of the Nigerian Stock Exchange by Adelegan (2004) found inconsistencies in the Nigerian stock market for the periods 1992 to 1993. As a result, it could not be concluded that the market was inefficient. The serial correlation tests and sign tests showed that the market did not follow the random walk hypothesis, while the Runs test suggested that the Nigerian Stock Exchange did follow a random walk. Yadirichukwu et.al. (2014), in their evaluation of the weak form Efficient Market Hypothesis, found empirical evidence from Nigeria that yielded mixed results. Based on the annual stock market returns of the Nigerian Stock Exchange (NSE) the market was found not to be weak form efficient, but based on the monthly stock returns, the Nigerian Stock Exchange (NSE) was indeed found to be weak form efficient. This proves that different methodologies could result in inconsistencies in results. Willemse (2018), on investigating the South African Exchange (SAE), showed that the price movements of gold, iron, ore and platinum using the Autocorrelation test, Runs test and linear unit root tests did not demonstrate randomness, and thus not weak form efficiency. Harrison and Moore (2012) studied the Middle Eastern and North African (MENA) region's stock exchanges for weak form efficiency. The authors note that these regions were characterised by illiquidity, thin trading, and sometimes ill-informed investors – similar to any emerging economy. The results of this study were that the MENA stock exchanges were inefficient. Similarly, Ntim et al. (2011), while using variance ratio tests based on ranks and signs, concluded that the African continent-wide stock price indices have significantly more potent weak form efficiency than their international counterparts.

A few studies have proven weak form efficiency. One of them is a study on Namibian Stock Market (NSM) where the exchange exhibited weak form efficiency for the period covering 1997 to 2012. The ADF test, PP test and Kwiatkowski-Phillips-Schmidt-Shin tests were used (Sheefeni, 2016). The automation of the Botswana Stock Exchange (BSE) and policy reforms after the 2008 financial crisis

had a positive impact on the Bourse, and it was found to be weak form efficient (Ambalal, 2018). The Kenyan, South African and Tunisian stock exchanges were also found to be weak form efficient, while the Egypt and Morocco stock exchanges were weak form inefficient over the period of January 2000 to April 2011, when the Kapetanios- Shin- Snell (SURKUSS) test with a Fourier function was used to test the five indices (Zhang et al., 2012).

In summary, the discussed studies indicate that although mixed results emerged in terms of the African Exchange Markets (AEMs), studies tend to lean towards the rejection of the weak form efficiency. Studies on weak form efficiency and semi strong efficiency for the AEMs are also scant. The question is why is it that the AEMs tend to lean towards the rejection of the weak form efficiency. In sub -Section 8.8, this question is addressed.

8.8 Framework for the introduction of index funds

This subsection answers the question as to why AEMs, including the Kenyan Exchange market, tend to lean towards the rejection of the weak form EMH. It discusses characteristics that are evident within AEMs that hinder them from becoming at least weak form efficient. These characteristics include illiquidity, low market capitalisation, low listings, a weak investor base, informational and disclosure deficiencies, and institutional and infrastructure indicators such as the settlement cycle, the number of trading days and auditing and reporting systems.

8.8.1 Africa Exchange Markets (AEMs) and the EMH

African exchange markets are fairly new and are not as developed and mature as the rest of the stock markets in the developed world. Scholars (Mlambo and Biekpe, 2007; The Oxford Business group and ASEA, 2022) state that the majority of the AEMs were formed in the late 1980's and early 1990's when the World Bank and IMF advised reform programmes in many African countries. Before 1989, there were only five stock exchanges in Africa as compared to 2012 when the number had increased to twenty-nine stock markets in Africa. In 2022, the number of AEMs has increased to 38. This is a tremendous increase within a short time. Between 1992 and 2002, most African stock markets doubled their market capitalisation. Despite the increase in numbers of AEMs, an increase in market capitalisation in a relatively short period and the superior returns that AEMs offer to investors do not suggest that the African exchange market is mature (Afego, 2015; Yartley & Adjasi, 2007).

The development of AEMs is important because of the benefits that the exchange markets offer an

economy. Some of the benefits include optimal capital allocation and opportunity and ease of market participants to take advantage of investment opportunities. Scholars (Yartley & Adjasi, 2007; Afego, 2015) point out that stock markets contribute to national economies because they facilitate and enhance the operations of the domestic finance systems. This is done through aiding in pricing, diversification of risk, and aiding the financial assets pricing process. As a result, information cost is reduced through the generation and dissemination of firm-specific information. The markets aid in financing new investment projects through channels such as IPOs, thus enabling companies to raise capital at lower costs and reduce dependency on the banking system. In this manner, resources are channelled to productive investments, which constitutes an efficient use of assets that results in enhanced firm value. The entire process aids in the diversification of investment capital, spread investment risk, and as a result, the mobilisation of national savings. Although the stock market in Kenya is still developing, it plays an important role. It includes the mobilisation of domestic savings to bring about the reallocation of financial resources from dormant to active agents, the enhancement of the inflow of international capital, as well as the facilitation of government's privatization programs (Capital Markets Authority, 2012). Thus, the general importance of the role of stock markets in the globe, and specifically in Africa, cannot be understated

Efficient exchange markets accomplish these functions of the stock market more effectively. The capacity of the AEMs to meet the roles of exchange markets effectively is doubted due to their inefficiencies as evidenced in empirical results. Afego (2015) emphasises this notion, stating that ability of AEMs to contribute to the financial development and growth of an economy depends on its informational, operational and allocation efficiency. Most AEMs are information inefficient, which affects the allocation of capital efficiency.

Earlier discussions indicated that the AEMs has scant empirical literature on the EMH. In addition, results of the investigations of the EMH tend to lean towards a rejection of the weak form efficiency. Scholars (Smith, 2008; Adelegan, 2009; Afego 2015) confirm that investigations of the African stock markets have found the markets to be mostly inefficient. The Kenyan stock market NSE, being an African market, has been equally proved to be inefficient in this empirical study. This study confirms Njuguna's (2016) findings that the NSE is not weak form efficient.

African Exchange Markets (AEMs) have characteristics that hinder them from becoming weak form efficient hence they do not follow the random walk hypothesis. According to (Afego, 2015; Mlambo and

Biekpe, 2005) these characteristics include illiquidity, low market capitalization, low listings, weak investor base, poor regulatory framework, poor accounting and reporting standards, lack of depth, competitiveness, and low literacy levels. Yartey and Adjasi (2007) strengthen the above point of view and list characteristics that hinder efficiency in AEMs as informational and disclosure deficiencies, lack of adequate supervision by regulatory authorities, AEMs are small with few listed companies and low market capitalization, low liquidity and inadequate institutional and infrastructure indicators. These institutional and infrastructure indicators include existence of market regulators, governing law, nature of clearing and settlement, settlement cycle, existence of an international custodian, foreign participation, exchange controls, nature of trading systems, existence of a central depository, number of trading days and auditing and reporting systems.

The macroeconomic environment is equally important in eradicating the problem of information asymmetry that creates weak form inefficiency. Yartey and Adjasi (2007) further add that sound macroeconomic environment enhances informational efficiency in AEMs, a well-developed banking sector, transparent and accountable institutions, shareholder protection and low predictable rates of inflation aid in this enhancement.

8.8.1.1 Market capitalization, liquidity, value traded and listing of the AEMs

Market capitalization, turnover ratio (measure of liquidity), value traded and number of listed companies of selected AEMs are indicated in the Table 8.1 and discussions of the same follows.

Table 8.1 Market capitalization, liquidity, value traded and listing of AEMs

	Mrkt Capital (% of GDP)		Turnover ratio (Liquidity measure) (%)		Value traded (% of GDP)		No. of listed companies	
	2020	2021	2020	2021	2020	2021	2020	2021
Cote d’voire	13.84	11.95	1.86	-	0.26	0.28	46	46
Egypt	14.58	11.32	25.25	38.89	3.68	6.1	246	240
Ghana	-	13.49	-	0.35	-	0.04	33	31
Kenya	24.92	21.18	1.88	2.26	0.47	0.47	59	60
Mauritius	61.34	56.40	4.33	5.05	2.66	2.85	95	93
Morocco	54.57	57.16	4.98	5.50	2.72	3.15	74	75
Namibia	20.88	17.58	3.76	1.95	0.78	0.34	11	13
Nigeria	9.8	13.09	6.19	4.39	0.60	0.57	180	177
South Africa	272.29	313.48	33.13	27.94	73.42	87.6	274	264
Tanzania	-	10.39	-	0.29	-	0.03	-	22
Malaysia	110.59	129.53	26.89	56.94	29.74	73.77	919	927
Australia	106.87	129.57	56.07	71.26	59.93	92.34	1952	1902
China	59.63	82.96	214.29	258.55	127.79	214.50	3777	4154

Source: World Development Indicators World Bank- IBRD-IDA Data 2022

Market capitalization of many AEMs is extremely low as compared to other exchange markets in the globe. For instance, the average market capitalization of sub-Saharan Africa for the year 2021 was 119.61

of the entire Sub-Saharan economy, while South African exchange which is the largest has a market capitalization of 313.48 of its GDP. Meaning that the rest of the sub-Saharan economies have very low market capitalization, Namibia was at 17.58 in the year 2021, while Kenya during the same year was 21.18 as indicated in table 8.1. The Oxford Business group and ASEA (2022) notes that as much as the AEMs' market capitalization has grown from Usd 260 billion in 2000 to Usd 1.6 trillion in 2021, AEMs have low market capitalization that comprises of only 2% of the total global capitalization. This is evidently very low.

The levels of liquidity as measured by the turnover ratio are very low for the year 2020 and 2021. Egypt and South Africa had some of the highest turnover ratios while Kenya's turnover ratios for the years 2020 and 2021 were extremely low at 1.88 and 2.26 respectively. In comparison to Malaysia, Australia and China at 56.94, 71.26 and 127.79 respectively for the year 2021.

Value traded as a % of the GDP was similarly, extremely low. Kenya reported the value of 0.47 for both years 2020 and 2021. South Africa on the other hand had value traded of 73.42 for the year 2020 and 87.6 for the year 2021. Egypt's value traded as a percentage of its GDP for the year 2020 and 2021 was 3.68 and 6.1 respectively. This is in comparison with the Malaysian value traded Figures for 2020 and 2021 of 29.74 and 73.77 respectively. Australia on the other hand had the values of 59.93 and 92.34 respectively. China had 127.79 and 214.50 respectively.

The number of listed companies in the AEMs is low as compared to other exchanges globally. Kenya has a total of 60 companies listed in the NSE. South Africa and Egypt have the highest number of listed companies in Africa at 264 and 240 respectively. Namibia has 13 listed companies, while Tanzania has 22. Other exchanges in the globe for instance Malaysia, Australia and China have 927, 1902, and 4154 respectively. The Oxford Business group and ASEA (2022) notes that the number of IPOs has declined significantly than before the pandemic in AEMs, this may be due to listing requirements and lack of transparency. The writers mentioned high number of companies that were delisted Johannesburg Securities Exchange (JSE) amounting to 24 companies, this contributed to decline in equity capital raised by 73% in Sub Saharan Africa in 2021.

8.8.1.2 Institutional and infrastructure indicators

In this sub-section institutional and infrastructural indicators for the AEMs are discussed. Institutional indicators as earlier discussed include: existence of market regulators, governing law, nature of clearing and settlement, settlement cycle, existence of an international custodian, foreign participation, exchange controls, nature of trading systems, existence of a central depository, number of trading days and auditing and reporting systems. Market regulators and laws governing the stock markets are in place for majority of the AEMs (UNDP, 2003; ASEA, 2009). The rest of the institutional and infrastructure indicators for the AEMs have been nonexistence or have been found wanting (Yartey and Adjasi 2007; Afego, 2015). ASEA (2009) further discuss institutional and infrastructure indicators and point out that clearing and settlement systems of AEMs have mostly moved to electronic system but a few countries still operate the manual system for instance Namibia, Uganda and Cameroon. Trading system for majority of the AEMs have been automated, Uganda and Botswana however maintained the manual call over floor-based system.

Trading is carried out during week days. Alagidede, (2008) states that the trading days are Monday to Friday with an exception of a few countries which are Egypt, Libya, Mozambique, and Uganda. Trading hours for the continent average at three hours a day, Botswana and Sudan for instance trade for only one hour each trading day. A few of the countries have adopted the trade settlement period of T+3 which is internationally accepted, the cycle however ranges from T+2 to T+5 (ASEA, 2009). This means that in majority of AEMs the settling process is slow and the trading hours are low, this has led to informational efficiency problems and as a result the markets are not as competitive as other markets in other developing nations.

Enforcement of the existing laws. Afego (2011) states that enforcement of already existing laws for AEMs by the authorities have been questionable. Regulatory system that works have been proved to enhance stock market efficiency as seen in discussions in chapter 2. The regulatory systems are accused of not working as they ought to.

Limitation of foreign participation has been reported. According to (UNDP, 2003; ASEA, 2009) there is the foreign participation cap in some AEMs. Ghana has a 74% cap on foreign ownership, Kenya has 75% cap on foreign ownership, while Tunisia has 49% cap on foreign ownership majority of AEMs have realized this limitation and are working towards remedying this for instance Ghana, Egypt and Mauritius have enacted tax incentives that also give benefits to foreign investors and others have come up with tax

treaties. It has however been noted that more can be done. In addition, international partnerships have also taken place for example partnership Ghana Stock Exchange and London Stock Exchange (The Oxford Business group & ASEA 2022). Despite efforts by AEMs foreign investors' participation remains low. The Oxford Business group and ASEA (2022) notes that even in AEMs where foreign investors are active their activity is quiet volatile for instance in the Kenyan NSE foreign investors fluctuated from a high of 75% in September 2020 to under 35% in August 2021. This volatility is a worrying phenomenon.

In addition to the foreign investors challenge AEMs have had challenges with local retail investors. "A weak local investor base has long characterized many African exchanges, and progress remains slow on the smaller markets, limiting liquidity and contributing to volatility" (the Oxford Business group and ASEA; 2022: 50).

On the other hand, majority of AEMs have been noted to have a central depository, Botswana and Uganda do not have central depository (ASEA, 2009).

Another weakness of AEMs is the lack of diverse investment products within the markets. This was echoed by The Oxford Business group and ASEA (2022) where they indicate that JSE has the most diverse exchange market products in the continent. Other AEMs are trailing behind. According to the writers Kenya follows with a number of products. It is advised that the AEMs need to offer a range of products to investors and especially in its bid to attract retail investors and foreign investors.

8.8.4 Characteristics of the Nairobi Securities Exchange (NSE) that hinder weak form efficiency

The NSE

Since the inception of the NSE commendable improvements has been made to the Kenyan capital markets in the past few years by developing its institutional and infrastructural indicators. The capital markets authority (CMA) has been placed as the NSE market regulator, laws regulating the exchange market have been put in place. The NSE has moved from a manual to an electronic system for clearing and settlement. The settlement cycle has been improved, Kalui and Musya, (2019) found that the clearance and settlement system used at the NSE is fast and effective with a good number of transactions being processed on time and this has led to increased turnover at the NSE. The central depository has also been established Kalui and Musya (2019). These improvements have led to the development of the securities market, there are however characteristics that are present within the market that hinder weak form efficiency. These characteristics are as discussed in the sub sections that follows.

8.8.4.1 Low market Capitalization

The stock market capitalization as indicated in Table 7.1 is the value of the listed shares divided by GDP. The market capitalization had reached a high of 50% in the late 2000's (World Bank, 2012), but it is evident from Table 7.1 that the market capitalization has decreased to 24.92 and 21.18 for the years 2020 and 2021 respectively. As compared to the South African market the NSE market capitalization is low relative to the size of the economy and it is still very low in comparison to other high-income countries on the globe. The level of securities market capitalization is an indication of stock market development and an indication of stock market informational efficiency (Aduda et al., 2012). Low market capitalization in the Kenyan NSE has been noted (Afego, 2015; Yartey & Adjasi, 2007).

8.8.4.2 Illiquidity

Table 7.1 indicates liquidity as measured by turnover ratio and it shows that the Kenyan level of liquidity is very low with ratio of 1.88 and 2.26 for the year 2020 and 2021 respectively. Liquidity generally refers to the ability to easily buy and sell shares. Although the World Bank (2012) indicated that between the periods of 1988 to 2010 with increase of market capitalization there was increase in value traded hence increase in liquidity. The increase in liquidity is never the less very low compared to the liquidity levels of South Africa and other countries globally. South Africa had a turnover rate of 33.31 and 27.94 for the year 2020 and 2021 respectively. Nyasha and Odhiambo (2014) acknowledge this in their discussions on challenges facing the NSE. The Oxford Business group and ASEA (2022) acknowledge liquidity challenges faced by many AEMs. Despite the fact that the turnover ratio of the NSE is higher than its East African Counterparts, by international standards the ratio is very low (Capital Markets Authority, 2012b). In addition, the "buy and hold" practice among institutional investors, who dominate the market does not help liquidity. (Capital Markets Authority, 2012b).

8.8.4.3 Low number of listed companies

Africa Exchange Markets are small with low numbers of listed companies (Yartey & Adjasi, 2007; The Oxford Business group & ASEA (2022). Kenya is not an exception to this characteristic of AEMs. Kenya currently has 60 listed companies World Bank (2022). This number is very low as compared to the South African securities market which has 264 companies listed and Malaysia that has 927 companies listed. The NSE (2012) stated that increasing the number of companies listed on the NSE has always been a challenge, and it has been specifically challenging to increase number of medium and large sized family

owned companies.

There has been a number of factors causing reluctance of non-listed companies to join the NSE. Wanjiku (2012) found that the stringent non favourable legal and regulatory requirements do not encourage non listed companies to join the NSE. The political risk was also a factor that was not favourable to non-listed companies. The unstable political environment did not encourage the companies to be listed in the NSE. In addition, private companies are not comfortable with public scrutiny that is in line with listing a company. According to the writer, non-listed companies are also weary of maintaining a company's image with regard to profitability and cooperate governance, this is costly and the companies are not ready for the extra expense. Many companies are of the view that they are not ready for expansion hence no need for public listing. The CMA (2012) mentioned that the reluctance of small and large family owned companies resulted from the fact that the companies were not ready to go through the costly and tedious process of making public offers, and they were not willing to dilute ownership.

8.8.4.4 Information asymmetry

Kalui and Musya (2019) found that there were barriers to dissemination of information and not all relevant information was publicly available. They advised that, unsuspecting investors can be harmed by those with access to information not available to the public. Managers of firms and financial market professionals had access to information. Due to this listed companies trading in NSE should be subjected to additional disclosure requirements imposed as listing rules.

8.8.4.5 Weak Legal and regulatory system and unfavourable laws

The government of Kenya has put in place laws to govern the securities market and a regulatory body for the capital markets, but there has been criticism over enforcement of the laws and complaints over laws being stringent to companies who would want to list. "This body enjoys plenary legislative and supervisory powers over market intermediaries and listed companies without being subject to meaningful accountability mechanism" (Gakeri, 2012: 265). This has led to the lack of reliable enforcement of the laws by the CMA and as a result investors and non-listed companies have lacked confidence in the markets. This finding were confirmed by Kalui and Musya (2019) when they concluded that favourable laws and enforcement mechanism should be put in place within the NSE to favour development of the Bourse. Wanjiku (2012) concluded that the legal and regulatory framework was not favourable in regards

to listing requirements of companies hence discouraging companies from listing in the stock exchange. The legal and regulatory framework encourages and promotes self-regulation, this has however not been implemented because the provisions for self-regulation are ambiguous and ineffectual (Gakeri, 2012).

8.8.4.6 Lack of awareness and information on the role, functions and operations of the NSE and CMA

The average Kenyan citizen does not understand the operations of the NSE neither do they understand the role of the CMA. This lack of education on the NSE, CMA and investment opportunities in the financial markets hinders many from participating in the markets, and consequently becomes a hindrance to informational efficiency. Nyasha and Odhiambo (2014) discussed that majority of potential participants of the NSE were not aware of the role, functions and operations of the NSE and the CMA. Majority of Kenyans are unaware of the investment opportunities available at the NSE and due to this ignorance they shy off the NSE. The NSE has not marketed itself aggressively, neither has the CMA which is the regulatory body of the NSE. This has hindered efficiency of the market. Many investors do not want to be involved with the market as they do not understand the market. Majority of potential investors and investors acquire information from newspapers and magazines, this information is not adequate for investment purposes. A deeper understanding of the securities exchange operations is required for one to trade efficiently yet majority of investors do not refer to professional financial advisors, books and guides that could help them achieve this (Wendo, 2015). The Oxford Business group and ASEA (2022) notes that the level of awareness of the stock market operations among retail participants is very low likewise level of retail investors participation in the market is very low.

8.8.4.7 Lack of Market transparency

Kalui and Musya (2019) suggested that the NSE might not be transparent. This is a hindrance to efficiency of the market. Kalui and Musya (2019:330) “emerging markets are likely to be less transparent than developed market and the degree of market transparency affects investors’ ability to gain information and develop performance expectations since transparency in dealings enhance the market confidence”. Harrison and Moore (2012) studied the Middle Eastern and North African (MENA) region stock exchange for weak form efficiency. The writers noted that these regions were characterized by illiquidity, thin trading, and sometimes ill-informed investors similar to any emerging economy. This characteristic is not specific to Kenya only but it is specific to emerging economies.

8.8.4.8 Cap on foreign ownership

Kenya has a 75% cap on foreign ownership. This hinders the flow of foreign capital into the country, hence hindering liquidity and eventually market efficiency (Kalui and Musya, 2019; ASEA, 2019; Yartey & Adjasi, 2007).

8.8.4.9 High trading costs

There are high operational fees that are charged by AEMs which hinder many from participating in the exchange market. Kenya is not an exception. The Oxford Business group and ASEA (2022) noted that in comparison to developed securities exchanges AEMs generally charge higher fees. Transactional costs of developed securities exchanges are below 1% whereas AEMs have higher fees that can go up to slightly above 4%. The fees include taxes, brokerage fees, clearing and settlement fees. For instance, according to the Oxford Business group and ASEA (2022) Uganda charges fees of 4.1% while Rwanda charges fees of 3.4%. These fees contribute to low transactions in the markets and lack of interest in the market from retail investors.

The discussed characteristics strongly imply inefficiency and specifically information asymmetry which is a violation of the EMH. This inefficiency leads to less-than-optimal allocations of capital resources within the economy, which should cause concern to investors, regulators and policy makers. Recommendations for removing the market to efficiencies are discussed in the following subsection.

8.8.5 Recommendations on improving informational efficiency of the NSE

The NSE plays an important role in Kenya. The optimal allocation of capital within the economy will enhance economic development. It is therefore important that policy makers and the CMA are keen in correcting the issues discussed above so as to create a more efficient Kenyan exchange market. This Section discusses recommendations on the way forward and suggests policy options that would aid in establishing a more efficient NSE. This paper follows policy suggestions from the IMF working paper on stock market development in Sub-Saharan Africa – critical issues and challenges by Yartley and Adjasi (2008), Alagidede (2008) proceeding of the African Economic Conference 2008; African stock market integration: implications for portfolio diversification and international risk sharing and market efficiency in developing African stock markets: what do we know? Afego (2015) and the Africa focus report (2022).

8.8.5.1 Integrating and harmonising the NSE with other AEMs

An integrated stock market is where investors in one country can buy and sell equities that are issued in another. According to scholars (Domowitz et al., 1998; Pieper & Vogel, 1997), stocks are issued and traded at the same price across markets after adjustment for foreign exchange rates. The integration and harmonisation of the NSE with other AEMs is recommended. This harmonisation will help to increase capital flow, solve the problem of small size and illiquidity. Harmonization will aid in increasing depth and information efficiency. Also (cf. Yartley and Adjasi, 2008; Onyuma, 2006), integration will solve the fragmentation problems that AEMs face. Economic capital and human capital can be brought together in one single market that promotes cost-efficiency, liquidity and the price discovery process. All operations should be harmonised so that the market will experience fewer complexities that are caused by fragmentation. In the case of integrating stock markets, risk management will be enhanced and access to information will be facilitated, leading to informational efficiency. Eventually, according to the authors noted above, integration aids in effective capital allocation and encourages listing and cross-listing. The increase in the number of listed companies will lead to more depth and diversification. More listings bring about more order flow to reduce transactions and operational costs. These changes would increase or stabilise share prices and reduce price volatility. Integration encourages individual investors to invest in securities because of increased confidence due to widespread exposure and improvements in the market. The expanded investor base will increase liquidity as well. Widened scrutiny of the listed companies from a wider public will encourage good corporate governance practices that suggest greater public confidence. In addition, integration will attract foreign investors. Ntim *et al.* (2011) emphasise the benefits of integration by adding that integration across markets produces more efficient markets than individual national economies.

Despite the discussed benefits of integration, there is greater work to be done before this can happen. Alagidede (2008) found that Africa shares weak trends with the rest of the world and that AEMs are not significantly influenced by others. Thus, geographical or economic ties are not important in the integration of the markets. This suggests that intra and inter-regional economic policies that touch on macroeconomic factors should precede market integration. Adjasi (2007) adds that there must be harmonisation of legislation, rules, listings, trading days, settlement and reporting standards. Legal harmonisation is imperative, and liberalised trade regime must be put in place. Most African countries' accounting and reporting standards do not match international standards. For integration to be successful,

accounting standards of member states must attain international standards. In addition, member states must ensure that automated systems are in place to enable national centres to log in. Lastly, currency convertibility is important in any integrated exchange.

In addition, integrating the markets is challenging because of fears associated with integration. The loss of control of national exchanges in integration has been a limiting factor as well and smaller economies are sensitive of being swallowed up by bigger economies which can result in them losing national capital to the bigger economies. These fears of African countries have played a role in the delay of integration of the AEMs (Yartley & Adjasi, 2007).

Despite these fears, progress has been made in terms of the integration of stock exchanges in Africa. The regional exchange Bourse Regionale des Valuers Mobiliers (BRVM) in Cote d'Ivoire has already been formed. This integrated exchange consists of eight West African countries of the West African Economic and Monetary Union (WAEMU). The second Bourse des Valeurs Mobieres Centrale (BVMAC) is also in existence (Oxford Business group and ASEA, 2022). More effort is made out West Africa to achieve integration of the exchange markets. In 2013, the West African Capital Markets Integration Council (WACMIC) was inaugurated, consisting of commissions and securities exchanges of the West African Economic Monetary Union. In December 2021, the group received a grant of \$ 850,000 from the African Development Bank to harmonise regulations and aid capacity-building in the region to encourage cross-border investment (Oxford Business Group and ASEA, 2022). According to scholars (Onyuma, 2006; Alagidede, 2008), the South African Development Community (SADC) and the committee of SADC stock exchange (COSSE) set up strategies aimed at developing an integrated real time network of securities markets within the region. The SADC is already implementing the strategies. In addition, the JSE has entered into memoranda of understanding (MoUs) with exchanges outside the SADC. The JSE has signed MoUs with Kenya, Uganda, Egypt, Ghana and Nigeria. Oxford Business group and ASEA (2022) noted that North African countries are in talks with other African Regions Bourses in efforts to foster integration. For instance, Morocco is building strong relations with West African countries. Finally, in East Africa, Kenya, Uganda and Tanzania have exchanged MoUs to promote the integration of their stock exchanges, and the East African Member States Securities regulatory authority was set up. Kenya needs to put more effort into encouraging integration with other exchanges.

Another effort aimed at encouraging integration is from the ASEA. According to the Oxford Business Group and ASEA (2022), the initiative known as the African Exchanges Linkages Project (AELP) was developed by the African Securities Exchanges Association (ASEA). Its aim is to connect the continent's leading exchanges and boost cross-border investment flows. This will aid in achieving the African Union's Vision 2063 on free flow of investment and capital. This is a pilot project that involves seven AEMs before including other AEMs. The seven Bourses include the BRVM, the Johannesburg Stock Exchange, the Egyptian Exchange, the Casablanca Stock Exchange, the Nigerian Stock Exchange, the Nairobi Securities Exchange, the Stock Exchange of Mauritius, the Ghana Stock Exchange and the Botswana Stock Exchange. This project seeks to address African markets and enable movement of capital and people, and to deepen economic integration and support investment in Africa. The ASEA used the AELP link platform that allows traders to trade in different markets in different regions. This platform began operations in July, 2021. The ASEA has noted challenges posed with the implementation of AELP, which include difficulties in harmonising the legislative base and the regulatory limitations of institutional investors. Also, there are a need for the harmonisation of exchange rate policies, the risk of capital flowing to larger economies, and a lack of information across exchanges. However, if the AELP were to be successful, the Oxford Business Group and ASEA (2022) note that investors will be able to enjoy reduced risk on investments. It will also be easier to source for financing for many companies, liquidity will be improved, transactional and operational costs will be reduced, and investors will experience a wider range of investment products. Therefore, Kenyan CMA should be in a position to invest its resources in the AELP in the efforts enabling its success for the achievement of integration.

8.8.2 Laws, rules, regulations and enforcement

The CMA enforcement actions have been heavily criticised. This weakness within the authority has led to a lack of confidence in both the Authority and the securities market. As a result, a weak investors base was created: "The CMA's enforcement approach over the period under review appears to have been largely informed by inclinations of the chief executive as opposed to institutional commitments, obligations, market exigencies and culture" (Gakeri, 2012: 290). There needs to be reforms within the Authority itself. Gakeri (2012) insists that there must an institutional commitment in enforcing the law, and an enforcement philosophy should be in place that works towards consistency and professionalism in enforcement of the law. Then, investor confidence in the capital markets will be enhanced.

Secondly, there must be an accountability mechanism. As much as the CMA is the regulating authority of the capital markets, for effectiveness purposes, it needs to be accountable. Gakeri (2012) notes that the lack of an accountability mechanism has caused laxity within the Authority. In addition, there needs to be clear and unambiguous rules and regulations regarding self-regulation. Gakeri (2012) notes that the guidelines on self-regulation were very ambiguous, even though the statutory enshrines self-regulation.

Laws should be favourable to attract more listings to the Bourse. Wanjiku (2012) found that regulations that were too stringent discouraged many unlisted companies from joining the Bourse. -makers need to ensure that regulations are not a hindrance to public listing. Favourable legal environment should be fostered that will assist in the creation of a more vibrant capital market with a large base of investors.

In addition, protecting investors from malpractices from insiders is priority and enforcing the well-structured and clear rule of law, in the context of an efficient judicial system, will prevent information asymmetry. Rules and regulations that ensure disclosure and transparency must be clear and enforceable. Adjasi (2007:25) emphasises this by noting that, “Regular disclosure, transparency and enforcement form an integral part of regulation and supervision. Important disclosure requirements include relevant information with regards to transactions, accounting and the identity of ultimate beneficial owners”.

8.8.3 Increase market capitalisation

The NSE market capitalisation is very low, as indicated in Table 7.1. Efforts need to be made towards attracting more capital to the securities market. Kenya still retains a cap on foreign capitalisation of 75%. This restriction limits the amount of foreign capital that flows into the NSE. Fear of capital flights and financial crises is a major cause of foreign capital capping. Lifting capital account restrictions would benefit African stock markets tremendously. In addition, integrating the AEMs would aid in attracting foreign capital and increase capital capitalisation in general (Adjasi, 2007).

8.8.4 Educate public on the role, function and investment vehicles of the Bourse

The majority of Kenyans are not aware of the role and functions of the NSE as indicated in earlier discussions. This ignorance deters the flow of capital to the markets and encourages a weak investor base. Potential investors – both individuals and firms – need to be educated and informed of the

investment opportunities available at the Bourse, the role of the Bourse and its functions. Indeed, “Increasing public knowledge about the functioning of the stock market could promote the development of the stock market in Africa. Knowledge about stock market activity can be improved through regular and intensive education programs. Educating the public about the role of the stock market can help increase the investor base and improve the liquidity of the stock market” (Adjasi, 2007:26). Efforts are made through the media, as discussed earlier, but more needs to be done.

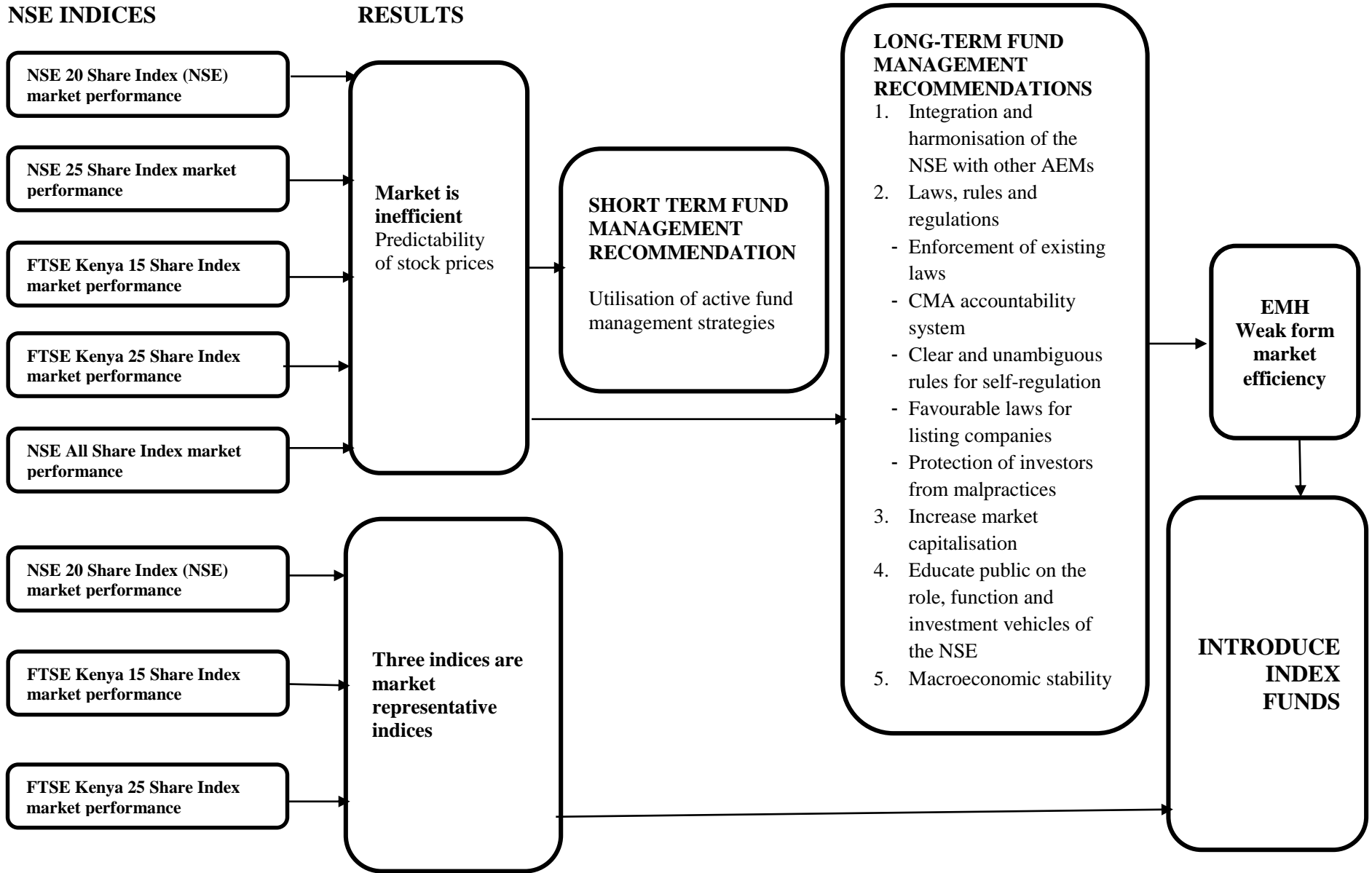
8.8.5 Macroeconomic stability

Efficient stock markets require macroeconomic stability, and especially the major macroeconomic indices need to be stable. Aduda et al. (2012) studied the Nairobi Securities Exchange and found that macroeconomic factors would lead to the development of the NSE. They point out income per capita, domestic savings, bank development, and low and predictable inflation rates as some of the factors that contribute to the development of the NSE. Unpredictable and volatile inflation rates and exchange rates deter foreign investors. On the other hand, domestic savings promote domestic investments (Afego, 2015).

8.9 Components of the framework for the introduction of index funds

Figure 7.1 below illustrates the framework for the introduction of index funds in the NSE. The components of the framework include the NSE indices, empirical results, recommendations for fund managers and investors for the short term, and long-term recommendations that will bring about weak form efficiency.

Figure 8.2 Framework for the introduction of index funds



Two of the factors necessary for the introduction index funds are the weak form efficiency of the Nairobi Securities Exchange and the market representativeness of the indices. This study found that the NSE is not weak form efficient, implying that the NSE is not ready for the introduction of index funds. On the other hand, the NSE 20 share index, the FTSE NSE 15 share index and the FTSE NSE 25 share index were found to be market representative. The implication of this finding is that the three indices can be utilised in the introduction of index funds. Index funds track and replicate or mimic market representative indices.

The results of this study show that the NSE does not follow the weak form EMH, implying that active fund management be applied as an investment strategy by fund managers. Consequently, fundamental and technical fund management strategies can be applied to beat the market. Active fund management strategies are defined as attempts by fund managers to outperform, on a risk adjusted basis, a passive benchmark portfolio (Reily & Brown, 1997; Robbins, 2014; Cuthbertson & Dirk, 2008). As mentioned in Chapter Two, Dragota and Tilica (2013) tested the predictability of returns for 20 East European former communist countries for the period of January 2008 to December 2010, to establish level of efficiency of the stock markets. Doubts about market efficiency of all the countries in the analysed periods were raised. Dragota and Tilica (2013) advised an active management strategy for these capital markets: “Higher levels of market efficiency imply use of passive management strategies while lower levels of efficiency imply the use of active management strategies” (Dragota & Tilica 2013).

Active fund management is only a short-term recommendation as indicated in Figure 7.1. This is because active fund management attracts hefty fund management fees that the Kenyan investor will have to incur. Bodie et al. (2010) note that active investment strategies are characterised by high fund management fees due to the compensation of financial analysts. The high transaction costs translate to lower returns in the long run as compared to passively managed funds.

Secondly, as much as market inefficiency would offer profit opportunities to active fund managers, it would also result in resource misallocation that eventually hurts the economy and results in underdevelopment. Therefore, active fund management is only recommended for the short term during the shift towards a more efficient market. Bodie et al. (2011) describe resource misallocation as a large cost that is usually borne by all citizens. This is the case because of mispricing of stock, and corporations

that are overpriced can raise capital very easily. However, under-priced stock will struggle to raise capital because it would be too costly to do so. This means that corporations that have a great potential to perform very well within an economy might not do so because of informational inefficiency: “Therefore, inefficient capital markets would diminish the potential benefits of a market economy” (Bodie et al., 2011:352). Informational market efficiency will result in proper resource allocation that will give rise to economic development within the society. Citizens will not incur the heavy cost of resource misallocation. A good example of resource misallocation is the dot-com bubble of the 1990’s where prospects of the internet and telecommunication firms were overinvested in, and later on the bubble burst (Bodie et al., 2011).

Hefty management fees are a core problem of this study. Index funds are hoped to be introduced into the market to enable investing without incurring hefty fund management fees. The market was, however, found not to be efficient in this study. In order to create an efficient market that will favour the introduction of low-cost index funds, Figure 7.1 shows long-term recommendations. If implemented, these will result in an informationally efficient market. A brief discussion of the long-term recommendations is given.

As noted, a long-term development of the NSE is required. The implementation of the long-term recommendations suggested in Figure 7.1 above will lead to the development of the NSE, and eventually lead to market efficiency. This will allow for the introduction of index funds. Investors will be able to benefit from index funds. The investors will also be able to earn higher returns in the long run, avoid hefty fees charged by investment managers, and enjoy a diversification of benefits.

The integration of the NSE with other AEMs will solve problems of low capitalisation, liquidity problems, the low number of listed companies, and also integrate capital and human resources to create a more efficient capital market. The enforcement of laws, rules and regulations by the regulating authority has to be addressed to create an investment environment that inspire confidence among investors. Creating an accountability system for the CMA will improve its regulatory work. Also, favourable laws will attract more listings. Laws, rules and regulations that protect investors from malpractices and laws that ensure disclosure, and transparency of participants of the NSE will increase the investor base and increase efficiency. Increasing of market capitalisation by considering increments of foreign capital, market integration and favourable laws to encourage more listing. Education of the

public on the role, function and investment vehicles available in the market should be considered. Macroeconomic stability is another factor that will improve the efficiency of the NSE.

Considering these critical areas and implementing policies that will favour the same will cultivate an environment that enhances informational efficiency in the NSE. This will create a more conducive environment for the introduction of index funds.

CHAPTER 9

Conclusions and recommendations

9.1 Introduction

This chapter presents conclusions and gives recommendations based on the previous chapter that discussed and interpreted the results. This chapter gives a discussion on policy implications of the study to the Kenyan capital markets, noting the contributions of the study and recommendations for future studies.

9.2 Conclusions from empirical results

The serial correlation test rejected the null hypothesis, implying that there is serial correlation between price changes over successive q -time lags hence dependence. The linear unit root tests results indicated an absence of unit root in all the series and hence stationarity. In addition, the non-linear tests; two regime and three regime threshold autoregression (TAR) provided further evidence that inferred stationarity. Finally, runs test and the variance ratio test yielded the same results of non-randomness of the data. These empirical results lead one to conclude that the Nairobi Securities Exchange (NSE) indices do not follow a random walk. The NSE is stationary, not weak form efficient, and violates the EMH. These results imply that index funds cannot be introduced to the Kenyan NSE. Index funds can only thrive in an exchange market that follows the Efficient Market Hypothesis, a market that follows a random walk.

Results on whether the current NSE stock indices are representative for the Kenyan capital market indicated that three indices were market representative. The FTSE NSE 15, FTSE NSE 25 and the NSE 20 stock indices of the NSE are representative of the Kenyan capital markets. As a result, the three indices can be utilised for the introduction of index funds in Kenya.

9.3 Policy implications

The NSE was found inefficient hence introduction of index funds is not practical at present. The implications of this finding are that the NSE has to be developed in order for it to become more efficient. Secondly, to address the problem of hefty management fees charged by fund managers, the NSE should be developed to become weak form efficient, hence follow the EMH. For this to be achieved the following policy implications are suggested:

- i) Integration of the NSE with other AEMs must be considered. This will solve problems of low market capitalisation, illiquidity, and the low number of listed companies at the Bourse. It will also enhance information symmetry at the market and increase depth of the NSE.
- ii) Secondly, enforcement of existing laws, rules and regulation by the capital markets authority (CMA) needs to be in place.
- iii) Third, an accountability system or body for the regulatory body the CMA must be established. This will cause the regulatory body to be accountable so that it enforces laws, rules and regulations on the market.
- iv) Rules and regulations for self-regulation of the NSE must be clarified through policy.
- v) Creation of favourable listing laws rules and regulations to encourage more companies to list on the NSE.
- vi) Adequate protection of investors from malpractices within the Bourse needs to be implemented and adequate laws, rules and regulations that ensure disclosure and transparency within the NSE must be formulated.
- vii) Increasing of market capitalisation by attracting foreign investment should be considered. Lifting foreign investment caps and applying tax laws that are more favourable to foreign investors need to be considered.
- viii) Educating the public on the roles, function, and investment vehicles in the NSE is a priority measure to increase capitalisation and grow the investor base. Lastly, this can help to achieve macroeconomic stability.

9.4 Contributions of the study and recommendations

The study contributes to the body of knowledge in the field by presenting a framework for the introduction of index funds. The empirical results of this study led to the development of framework for the introduction of index funds in the Kenyan financial markets. This framework is derived from the results that sought to address the research problem. The results indicated that the NSE is not efficient, implying that index funds cannot be introduced in the market. Thus, a framework has been developed that will enhance informational efficiency in the NSE. The establishment of informational efficiency within the NSE will resolve the problem of hefty active managers' charges. The framework suggests both long-term and short-term recommendations that include policy recommendations.

This means that the study has made a contribution to policy. Through the framework, policy suggestions were made, and these policies can be implemented in the Kenyan financial markets. The implied policy recommendations can also be applied to other AEMs, because AEMs experience similar characteristics and problems as discussed earlier.

A number of shared characteristics hinder efficiency in African markets. This has been proved by majority of empirical studies on AEMs where results tend to lean towards inefficiency in the markets. These policies can therefore be applied to other AEMs that have been found to be weak form inefficient.

Contribution to practice: On a short-term basis, the framework suggests the use of active management strategies as suggested by Phiri (2015). Where the market proves to be inefficient, investors and institutions can utilise active management strategies and stock price movements can be exploited for higher returns. The discussions in this study proved that active management strategies tend to have hefty management fees that in the long run cancel out the gains of the investors. According to scholars (Elton & Gruber 1997; Bodie et al., 2010) active investment strategies are characterised by high fund management fees due to compensation of financial analysts, high transaction costs, and lower returns in the long run as compared to passively managed funds. For this reason, low-cost index funds were recommended. The framework thus makes long-term recommendations that will develop the NSE and enhance information efficiency that will allow introduction of index funds. Recommendations that will lead to the introduction of index funds in the NSE are integration and harmonisation of the NSE with other AEMs, enforcement of laws, rules and regulations by the CMA, creation of an accountability system for the NSE, creation of favourable laws, rules and regulations that favour listings and participants in the NSE, increase of market capitalisation, educating the public on the role and function of the NSE and investment vehicles at the Bourse, and lastly, enhancing macroeconomic stability.

Contributions to existing literature. Scholars (Smith, 2008; Adelegan, 2009; Afego 2015) confirm that investigations of the African stock markets have found the markets to be mostly inefficient and that AEMs has scanty empirical literature on the EMH. This empirical study makes a contribution to existing literature on EMH and knowledge on the level of efficiency of the AEMs, specifically the Kenyan NSE. In addition, the study proved that studies on the EMH of the AEMs tend to lean towards information inefficiencies. As noted in Chapter One, the study also contributes to the ongoing debate on passive and active fund management.

The study contributes a conceptual framework where the relationship between variables are clearly indicated. The five NSE indices were the independent variables while introduction of index funds was the dependent variable. The role of the underlying theory which is EMH was illustrated in this framework. Efficiency in the NSE was found to be important in solving the study gap or the problem. Market representativeness of the indices as measured by the NASI was further explained in the framework.

Furthermore, the methodological contribution of this study entails a long side linear unit root tests. The study applied nonlinear unit root tests to test the NSE indices data for the current level of efficiency. The data generating process indicated non-linearity. As mentioned, Enders and Granger (1998) and Caner and Hansen (2001) showed that the conventional linear unit root tests have low power in testing for unit roots when underlying data generating processes are found to be non-linear, justifying the use of non-linear unit root tests. Thus, the non-linear two -regime threshold autoregressive model was applied (cf. Enders & Granger, 1998) and Bec, Salem, and Carrasco's (2004) and three-regime threshold autoregressive test.

9.5 Limitations of the study and Future research

This research established non-linearity (the presence of structural breaks) in the data generating process. Abakah et al. (2018) note that stock returns in emerging markets behave in a non-linear manner, and this should be taken into account during testing for market efficiency. The application of a non-linear model when testing for market efficiency is recommended. This study utilised the Enders and Granger (1998) two-regime threshold autoregressive model and Bec et al.'s (2004) three-regime threshold autoregressive test. These are non-linear unit root tests that consider a limited number of structural breaks. Abakah et al. (2018) advise applying the nonlinear Fourier unit root test advanced by these authors (Becker et al., 2006; Enders & Lee 2012). The model allows for a possible unknown number of structural breaks and non-linearity in DGP. This study limited itself to the TAR models that only consider a limited number of structural breaks. Therefore, it is recommended that further studies that implement the Fourier unit root test be carried out on the NSE data. This will provide better insight into the state of market efficiency when more structural breaks are considered.

One of the characteristics of AEMs is thin trading. Abakah et al.'s (2018) account of thin trading this study does not account for thin trading. This characteristic hinders efficiency of the AEMs. Thin trading can influence results as evidenced by Abakah et al. (2018). This research did not adjust for thin trading;

it is thus recommended that thin trading should be accounted for when carrying out further research on the efficiency of the NSE.

This study assumed that there is an adequate regulatory framework in the Kenyan capital markets. This is because, within the period of 2013 to 2018, Kenya's financial sector became the third largest in sub-Saharan African country with continued regulatory reforms within the sector being done. The following acts were passed into law: the Finance Act, the Capital Market Act, and the New Company Act (PMC, 2017; Oxford Business Group, 2016). This assumption is a limitation in this study. It is then recommended that further research can be carried out to establish the adequacy of the Kenyan regulatory body.

Finally, this study recommends further research on levels of market efficiency for other East African markets and other AEMs using more robust models that consider non-linearity in the DGP. This will enable the researcher to determine the market efficiency of these markets. Also, it may point to steps to take in the event of inefficiencies arising in the market. Future research may also consider adopting the suggested framework to improve the efficiency of AEMs in the case of an inefficient market.

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Appendix A

Kenyan Financial sector

Banking Sector

The banking sector institutions numbers have generally increased over the years, and by the end of 2019, the institutions according to the CBK bank report number as follows: 42 banking institutions (41 commercial banks and 1 mortgage finance company). Out of these, 22 commercial banks are locally owned and 17 are under foreign ownership. There are nine representative offices of foreign banks, 14 microfinance banks (MFBs), three credit reference bureaus (CRBs), 17 money remittance providers (MRPs), eight non-operating bank holding companies, one mortgage refinance company and 66 foreign exchange (forex) bureaus as on December 31, 2020.

The Central Bank of Kenya (CBK) is the regulatory body of the banking sector and according to CBK (2019) the CBK's role include processing licenses of commercial banks, non-bank financial institutions, mortgage finance institutions, building societies, foreign exchange bureaus, microfinance banks, credit reference bureaus, mortgage refinance company and money remittance providers. The body also conducts on-site and off-site inspections and surveillance, checking on financial conditions and noting compliance with legal requirements. The Department also processes corporate approvals for banking institutions. It hosts the Secretariat for the National Task Force on Money Laundering (NTF) whose mandate is to develop a legal and regulatory framework to counter and prevent the use of the Kenyan financial system for money laundering. The CBK also participates in regional activities organised by regional and international bodies. Finally, the bank arranges for the signing of memoranda of understanding (MOUs) between the Central Bank of Kenya and relevant stakeholders.

Generally, the banking sector has grown and between 2019 and 2020, there were improvements in total assets, capital reserves and deposits. CBK (2020) noted the growth and said that the total banks' assets have increased to Kes. 5.4 trillion as on December 31, 2020. This can be compared to Kes.4.8 trillion as at December 2019, marking a growth of 12.4%. Furthermore, capital reserves of banks according to their sizes has increased. "In 2020, the banking sector's capital and reserves increased by 10.8 percent from Ksh.728.82 billion in December 2019 to Ksh.807.46 billion in December 2020. All the peer groups registered increased capital and reserves (CBK, 2019:7). In addition, there was increments in bank deposits for all bank categories. CBK (2019) deposits increased from Ksh.3.60 trillion in December 2019

to Ksh.4.1 trillion in December 2020 due to agency banking and mobile phones platform. Rather, there were significant improvements during this time, which is an indication of a promising future within the sector.

As much as the banking sector experienced growth in the mentioned areas, there was a decline in profits as well as in the number of automated teller machines (ATMs). CBK (2020:7) reported that “profit before tax decreased by 29.5 percent to Ksh.112.2 billion in December 2020 from Ksh.159.1 billion in December 2019. The decrease in profitability is attributed to an increase in expenses (Ksh.77.47 billion) compared to increase in income (Ksh.30.54 billion).” As noted, the number of automated teller machines has also decreased. According to CBK (2020), this is attributed to the implementation of mobile banking and digital banking (CBK, 2020). It maybe deduced that the banking sector is embracing innovation and fin-tech systems are also being embraced by banks.

Moreover, the number of the MFBs increased from five banks in 2010 to fourteen by December 2020, and three of these were community microfinance banks. Another eleven of these banks held a nationwide microfinance bank license (CBK, 2019; financial sector regulators, 2011). In addition, the number of branches country wide has risen from 118 in 2019 to 123 in 2022 third party agents of the bank increased from 2,010 in 2018 to 2,447 more recently, and marketing offices increased to 119 from 11 in 2018 (CBK, 2019). It is interesting to note that despite number of banks increasing the microfinance banks have also increased, leading one to believe that microfinance banks are as important as financial institutions in Kenya.

Despite the increase in the number of MFBs and the number of branches of these, many of these banks have experienced losses in the recent past. According to CBK (2019), in 2018, the MFBs registered a loss of Ksh.1.4 billion before tax, while in 2019, a loss of Ksh.339 million before tax was reported. These cumulative losses led to capital levels decline of the MFBs in 2019. However, there has been an improvement of performance as evidenced by a decrease in losses (CBK, 2019).

Other areas of development and improvement in the MFBs include the asset levels, loan advancements, increases in deposits, and a general growth in market share. According to the CBK bank supervision annual report (2019), deposits increased from Ksh.41.0 billion in 2018 to Ksh.43.9 billion in 2019. This constitutes a 7% increment, and the growth is attributed to agency banking, mobile banking and increase

in MFB branches countrywide. CBK notes that there was an 8% increment of total assets from Ksh.70.8 billion reported in the year ended 2018 to Ksh.76.4 billion in the year ended 2019. Loan advancements also increased; this is because MFBs used technological platforms to offer loans to customers as well as the general increase in demand of credit from various sectors. There was a 5.6 percent increase from Ksh.44.2 billion in 2018 to Ksh.46.7 billion in 2019. The upward trajectory was attributed to increased demand for credit by the various economic sectors, as well as increased adoption of technology as a lending platform. According to the bank, the main sources of funding for the MFBs were customer deposits and borrowings. Large banks had an aggregate market share of 84.6 percent as on December 31, 2019. The medium MFBs market share was 13.8 percent and small MFBs had an aggregate market share of 1.6 percent. At the same time, there was a decline in market share of 3.9% and 0.9% for the large and medium sized MFBs, and there was an increase of 4.1% for small sized MFB. Thus, there seems to have been an overall growth in market share by these banks.

Savings and the credit cooperative societies (Saccos) sector

Cooperative movements in Kenya were introduced during colonial times, and were used to encourage savings and enabling borrowing amongst farmers for economic development. These cooperatives developed into marketing associations that were used to market farmers produce. Today, the cooperative movement is categorised as a financial institution. Saccos and non-financial cooperatives were popularised in the 1990's. Sassra (2010) explains that in the 1990's, the financial Saccos were popular because the Government of Kenya required banks to retain a very high operating minimum for personal accounts. These forced middle- and low-income persons to find an alternative in Saccos. To this end, the Saccos opened its Front Office Services Activity (FOSA), which provided banking services that enabled members to make deposits and withdrawals. This means that cooperatives were retaining a very low minimum for personal accounts, which explains the popularity of this initiative. Saccos are both non-withdrawal and withdrawal facilities where members are allowed to withdraw in the same manner as they would from banks. Financial regulators (2010:44) suggest that "Saccos engage in Back Office Savings Activities (BOSAs), Front Office Savings Activities (FOSAs), or both. The Sacco societies operating FOSAs undertake near retail banking business operations".

The Sacco sector grew during colonial and post-colonial times, and even greater growth was experienced in the 1990's. However, there has been a decline in the number of Saccos in the 2000's. Sasra (2011), in

the Sacco supervision report of 2010, notes that 50% of cooperatives in 2010 were registered as Saccos and the total number of registered Saccos at that time was 6,737, out of which only 3,280 were active. Out of the active Saccos, 215 of them were deposit-taking Front Office Savings Activities (FOSA) operated, while 3,065 operated Back Office Savings Activity (BOSA). In contrast, the number of deposits taking Saccos had reduced by year 2020. Sasra (2020) reports that as of the beginning of 2020, Sasra (which is the regulatory authority of Saccos) had issued deposit-taking licenses to 173 deposit-taking Saccos in the country. The licensed deposit-taking Saccos were published in the *Kenya Gazette* Notice No. 761 dated 31st January, 2020 in full compliance with the provisions of Section 28 of the Sacco Societies Act. This suggests that there has been either competition from the banking sector and microfinance institutions, or some of the Saccos could not meet the regulatory requirements to continue operations. However, Sasra (2020) indicates that there has been a slight increment in the number of branches from 520 reported in 2010, to 537 branches reported in 2020.

Inasmuch as the number of Saccos in the Kenya has decreased, the Saccos has seen significant growth since 2006 to date. The growth indicators were total deposits, total assets, share capital and turnover. Sasra (2010) reports that the total assets for the years 2006, 2007, 2008, 2009 and 2010 grew gradually, and were Kes in millions 105 533; 115 900; 134 018, and 146 167, respectively. This demonstrates a growth of 52%. This were funded by deposits or savings that more than doubled in the same periods. The deposits were Kes in millions, respectively, 5, 113; 61,753; 71,110; 105,929; and 123,137. This represents an increase of 141%. However, the deposits were not able to match the borrowings, which is an indication that Saccos had to seek financing to meet lending obligations. The loan advancements increased in the same period and the numbers were Kes. in millions 68 302; 77 356; 90 984; 102 514, and 123,492 respectively. The share capital increased for the years 2006, 2007, 2008, 2009 and 2010, and the share capital amounts were Kes. in millions 2 030; 2,473; 2 720; 4 242, and 5 413 respectively. As a result of this data, one can presume that there was sufficient demand for Sacco services by the public in the years between 2006 and 2010.

There has also been an increase in the number of members despite the drop in the number of registered deposits taking Saccos. The Sacco Supervision Report of 2010 published by Sasra (2010) reported that the 215-deposit taking Saccos had 1,546,966 members. In 2020, the report by Sasra (2020) indicated an improvement in the number of members. The report shows that by the year 2018, there was a membership

of 4 193 158. By 2019, the number of members increased to 4 509 316, a 7.54% increase. And, by the end of 2020, deposit taking Saccos had a total number of 5 470 192 members which shows an increase of 21.31%.

Insurance sector

Growth and transformation in the insurance sector have been experienced in terms of the number of participants within the sector and other indicators of growth for instance gross direct premiums have increased. The report mentioned above further that the sector between the years of 2006 and 2010 experienced gross direct premium growth of 18%. The total premiums for the years 2006, 2007, 2008, 2009, and 2010 were Kes. 41,475, 358; Kes. 48,012,987; Kes. 55,245,838; Kes. 65, 012, 837; and Kes. 76,442,384 respectively. In addition, total assets showed a growth of 25% between the same period and the assets were Kes. 124,737,706; Kes. 146,541,007; Kes. 154,452 739; Kes. 178,403, 820 and Kes. 222 762 366, respectively.

During the period from 2006 to 2010, there were reforms in Kenya in many sectors towards Vision 2030. The insurance sector also experienced reforms that enabled the sector to overcome a number of challenges at that time. Financial regulators (2011) mentions that challenges at that time included poor cooperate governance, insurance fraud, poor performance of some insurance sectors, low insurance products uptake, and micro insurance. As a result of the challenges, policy development was done to control these challenges and to ensure that Vision 2030 is achieved within the sector. Financial regulators (2011) outlines some of the policies put in place by the Insurance Regulatory Authority (IRA). These include promoting fair and efficient markets to enhance stability in the insurance industry by guaranteeing consumer protection. The Department of the Insurance Regulatory Authority established a consumer education department at IRA, simplifying policy documents for ease of understanding and adopting ICT for effective service delivery. Clearly, a more efficient insurance sector was emerging. Moreover, Financial regulators (2019) indicates that further enhancement of the regulatory framework continued into 2018 where amendments to the Insurance Act was made. Amended areas include group-wide supervision, the harmonisation of provisions on capital requirements, risk-based capital and investment guidelines, and capital adequacy guideline and legal notices. These justify the presence of a regulatory framework in the sector and seems to cover a number of issues. If the regulatory framework is adequately implemented and is favourable to sector participants, it can be assumed that the framework is adequate for the sector.

The pension sector

The National Security Savings Fund (NSSF) is government-owned, and is the largest participant of the pension sector. This is because it is a mandatory for all employees in Kenya make pension contributions to this governmental body. Financial regulators (2019) report that “of the total assets held by the industry in 2010, Ksh. 104.2 billion or 23.1% was held by the National Social Security Fund, while the balance belonged to occupational and individual retirement benefits schemes and managed by the various fund managers”.

There is no financial sector that is without risk. The pensions sector, likewise, faces risks. Financial regulators (2019) name these risks as investment risks, interest rate risks, market risks, interest risks, solvency risks, fixed deposit risks, face interest rate risks, solvency risks, inflation risks, liquidity risks, currency risks, credit risks and governance risks, depending on what kind of investment a scheme chooses to invest in. To counteract these risks, the RBA has initiated guidelines in line with each risk in an attempt to ensure that pensioners’ investments are safe and that retirement bodies act in an ethical manner.

Capital Markets Authority

CMA regulates a number of institutions, and as mentioned earlier, the licensed and approved institutions operating under the CMA according to the CMA Annual report (2021) are one central depositories, one securities exchanges, five credit rating agencies, two authorized securities dealers, twenty one authorized depositories, fifteen investment banks, twenty five fund managers, nine stock brokers, seventeen investment advisers, ten REIT Managers, three REIT Trustees, three authorised REITS, twenty seven registered collective investment schemes, fourteen registered Employee Share Ownership Plans (ESOP), four non-dealing online foreign exchange brokers, one money manager, one coffee exchange, and five coffee brokers (one of which is fully licensed and four having conditional licenses). Products offered by the CMA are offered under the auspices of these institutions in both primary and secondary capital markets.

The existing primary capital markets also offer a range of products approved by the CMA. These products range from equity issues, rights issues, stock splits, bonus issues, corporate bonds, and treasury bonds. Companies that issued shares in this proportion are Equity Bank (issued 90, 500, 000 shares in the year 2006 at Kes.90.00), and CFC Insurance Holdings issued 515 270 364 shares in 2011 at Kes. 6.15. In turn,

Trans Century Limited issued 267, 038, 090 shares in the year 2011 at Kes. 50.00. Furthermore, Longhorn Publishers issued 58, 500, 000 shares in 2012 at Kes. 14.00, while CIC Insurance issued 2,179,615,440 shares in the year 2012 at Kes. 3.50, Umeme issued 1,623,878,005 shares in 2012 at Kes. 8.80. Home Afrika Ltd. Issued 405,300,000 shares in 2013 at Kes. 12.00. In addition, Flame Tree issued 24,287,500 shares in 2014 at Kes. 8.00 and Kurwitu Ventures offered 102,272 shares 2014 at Kes 1,250.00. Nairobi Business Ventures issued 23,600,000 shares in the year 2016 at 5.00, Barclays New Gold ETF issued 400,000 shares in 2017 at Kes. 1,205.16. The Bank of Kigali group Plc issued 896,759,222 shares in 2018 at Kes. 30.00.

The most recent issuer has been the Homeboyz Entertainment Plc which issued 63,200,000 in 2020 at Kes. 4.66. This data implies growth among the primary markets in terms of equity issued. Based on the equity issues, one can must presume that the primary market has been very active and vibrant market. In addition to this, rights issued from 2007 to 2021 amounted to 8,441,105,191 and the sum raised was Kes. 124,360,078,155.10. The most current rights issue was by Crown Paints Kenya Plc in the last quarter of the 2020/21 financial year, the company issued and listed new ordinary shares on the NSE. The results showed an oversubscription of 13.74% and an additional 16,685,851 shares were raised amounting to a total of 80,959,470 shares issued (CMA, 2021). The Authority has also reported bonus issues between 2013 and 2021 issued by 20 of the listed companies and stock splits were experienced between 2007 and 2017 from 11 listed companies (CMA, 2021).

Corporate bonds were also issued according to the Authority. These bonds were issued by Centum Real Estate Limited, who issued a private placement to raise Shs.4 billion with a Green Shoe Option of Shs. 2 billion for housing projects. Secondly, Family Bank launched its Shs.8 billion Medium Term Note Programme with the first tranche offering Shs.4 billion being oversubscribed by up to 147 percent, to support bank's capital base. This demonstrates that the Kenyan capital markets have the potential to experience greater growth, and thus the suggestion of introducing more products to the capital markets.

Equity turnover for the year 2006 was Kes. 95 billion, 2007 and 2008 had an equity turnover of Kes 89 billion and Kes. 98 billion respectively. The year 2009 reported a sharp decline, showing an equity turnover of Kes 38 billion. In 2010, the equity turnover was 110 billion. The bond turnover for the years 2006 to 2010 was 49, 85, 95, 111 and 479.09 respectively. The CMA, in the same report, shows a positive

percentage change that was experienced for the years 2020/2021 for the equity turnover, share volume, market capitalisation and bond turnover of 14.94%, 19.01%, 28.35%, and 47.94% respectively despite the effects of the Covid-19 pandemic.

These positive percentage changes were experienced after recovery strategies were put in place by the Kenyan government and the CMA with the aim of reviving the market. The bonds turnover and the market capitalisation percentage changes were incremental, but the equity turnover and share volumes were decremental. This leads us to believe that though the secondary market is a developing nation's market, it is an active market that is showing growth potential.

The Covid-19 pandemic affected equity turnover, but it seems as if the market is recovering. In addition, to the above-mentioned issues, statistics from the Kenya financial sector stability report (2018) show that the net assets as at 31st December 2018 under fund managers was Kes. 6,321.86 million, while net assets under stockbrokers were Kes. 1,638.36 million. Investment banks had a total of Kes. 8,890.32 million worth of net assets under them and investment advisors had Kes. 1,302.82 worth of net assets. The Online Forex Broker (Non-dealing) had net assets of Kes. 2.40 million.

Regardless of the development in the capital markets and efforts of the CMA, there has been an increased net portfolio outflows of foreign investors. The CMA (2020) records net portfolio flows for the years 2014, 2015, 2016, 2017, 2018, 2019, 2020 and 2021 as Kes. in millions 3,530, 916, 5,759, (11,583), (22,965), 1,378, (28,629), (2,985) respectively.

Deepening of the financial markets is the responsibility of the CMA, this is achieved through strategic partnerships, targeted stakeholder engagements and pursuing innovations and promotion of CMA products and services. CMA (2021) explained that the strategic partnership was with the following institutions: Chartered Institute for Securities and Investment (CISI), and the Kenya Bankers' Association (KBA). Other financial regulators were also involved in the partnerships including the Central Bank of Kenya (CBK), the Insurance Regulatory Authority (IRA), the Sacco Societies Regulatory Authority (SASRA) and the Retirement Benefits Authority (RBA). Further partnerships involved the Institute of Certified Public Accountants of Kenya (ICPAK), the Institute of Certified Investment and Financial Analysts (ICIFA), the Kenya Diaspora Alliance (KDA), the Kenya Association

of Investment Groups (KAIG), Amalgamated Chama Limited and the Kenya Private Sector Alliance (KEPSA), as well as local radio and television stations and the Kenya National Chamber of Commerce and Industry. These institutions collaborated with the CMA in its role to deepen the market, to help the private sector access capital markets and bridge developmental funding gaps and support economic growth. The partners collaborated by launching several initiatives with the CMA, as well as holding forums and exhibitions.

Some of these initiatives included county initiatives and vernacular radio campaigns. For instance, CMA (2021) states that through collaboration with IRA, two open day events were held in Kisii and Mombasa County. A trustees' conference in Mombasa County and radio campaigns sensitising Kenyans on the uptake of investment products in vernacular were also held for the Isiolo and Laikipia Counties. The Authority also explains that awareness of the capital markets has also been created through local television stations in local shows like "Daring Abroad" which targets Kenyans in the Diaspora and webinars have been held as well that target Kenyans in the Diaspora. These webinars were targeted to create awareness of capital markets products, how to invest in Kenyan capital markets, investor protection and tackle challenges by Diaspora investors.

This implies that capital markets would like to capture Diaspora remittance into the Country that are increasing. The CMA advertised a capital markets script on a popular citizen television show aimed at enhancing public awareness of the uptake of capital markets products and investor protection. In addition, the Authority has continually campaigned on social media platforms creating awareness on these platforms' investor protection as well as products and services offered by the capital markets. It may be deduced that these efforts of the CMA in collaboration with these institutions indicate a commitment from the CMA to educate the public on the uptake of products offered through the capital markets. The CMA has also made efforts to reach the public through the vernacular language and favourite TV programmes. This suggests that more Kenyans are becoming aware of the investment opportunities offered by the capital markets. Therefore, if these efforts are consistently applied, an increase in product uptake and subsequently increased investments is likely.

Further awareness of the capital markets and its operations is being created through associations with strategic partners' forums and exhibitions that take place. According to the CMA (2021), youth forums

have been created where youths in higher learning institutions, youths in employment and youths in entrepreneurship are educated on capital markets products and services, investor protection, career preparedness in financial services and awareness of online forex trading. Forums and exhibitions are presented in collaboration with the Chartered Institute for Securities and Investment (CISI), the Institute of Certified Investment and Financial Analysts (ICIFA), market intermediaries and other professional institutions and the Insurance Regulatory Authority (IRA). These forums target institutional investors, structured groups, professionals, trustees to create awareness on products they could invest in, investor protection, and enhance product uptake.

Stakeholders' engagements have also been carried out to ensure that the markets develop and meet the market needs of the population at large. Stakeholders have been involved through forums as mentioned above. Other forums that have made this possible according to the CMA annual report 2021 include the annual Trustee Forum, the Inaugural Capital Markets Consultative Forum, the National Capital Markets SME Forum, Real Estate Industry Engagements, Islamic Finance stakeholder engagement webinars and county engagements. The Authority seems to make a concerted effort to address capital markets' development issues through the forums. This demonstrates that there is a commitment from the CMA to develop capital markets.

According to the CMA annual report (2021), these platforms have enabled the Authority to open dialogue on matters such as the need for stronger advocacy for policy and legal incentives to facilitate MSMEs specifically, through capital markets and the submission of pro-MSME policy proposals and incentives to the National Treasury to support MSMEs' capital-raising efforts through capital markets. The Review of Public Offers and Listing Disclosures regulations are to be made more favourable for the SMEs to raise capital through capital markets and continuous stakeholder engagements with MSMEs and relevant companies to understand and address their financing needs. Other issues addressed through the Real Estate Industry Engagement included opportunities in the REITS Market in Kenya, challenges facing issuers and how to handle the challenges. Uptake of REITS products were also discussed. Operational structure and requirements in structuring and operationalising both Income and Development REITS in the capital markets was also dealt with. Regulations, industry policies, legal and operational challenges impacting the REITs Industry were addressed.

Therefore, the CMA obtained information that can enable it structure and improve REITs uptake in the country. The CMA annual report (2021) informs that the Islamic Finance forums could reach consensus on Islamic products, and the uptake of the products in capital markets. In addition, the CMA through county forums could create awareness of, and facilitate dialogue on issues that affect the county in terms of capital markets' operations awareness and the accessibility of financing through the capital markets (CMA annual report 2021).

Collective Investment Schemes (CIS)

The legal regulatory framework of a unit trust consists of a fund manager, a trustee, a custodian and an auditor who are all licensed or approved by the CMA; the regulatory body is therefore the CMA. The CMA (2022), in its CIS regulations, states that a fund manager who shall be independent of the trustee and authorised depository shall be appointed and a trustee, in the case of a trust; and a custodian. A trustee safeguards all interest of unit holders by ensuring that the fund is well managed, proper books of accounts are kept and that the custodian takes into custody the entire fund Portfolio, documents of title, and cash in accordance to the Trustee Deed and CMA. The trustee holds the investments on behalf of the investors. In turn, the custodian maintains all investment records and keeps all documents of title for all investments. The custodian is responsible for receiving cash and making all payments to investors. The fund manager issues instructions on how funds should be invested and maintains records of every individual investor and keeps book of accounts. The auditor audits books of account and issues annual reports and give his opinion on the position of the scheme. Thus, a regulatory framework and structures of operating unit trusts are in place for this kind of collective funds. One can therefore assume that there is an existing regulatory framework in place for the introduction of index funds. Also, one can therefore conclude that if index funds are introduced, the regulatory framework that will enable their operation is in existence.

The CMA website list of licensees as at May 2022 shows the unit trust schemes licensed by the CMA as Alliance Kenya Unit Trust Scheme, British-American Unit Trust Scheme, NCBA Unit Trust Funds, Zimele Unit Trust Scheme, ICEA Unit Trust Scheme, Standard Investment Trust Funds, CIC Unit Trust Scheme, Madison Unit Trust Fund, Dyer and Blair Unit Trust Scheme, Amana Unit Trust Funds Scheme, Diaspora Unit Trust Scheme, First Ethical Opportunities Fund, Genghis Unit Trust Funds, Sanlam Unit Trust Scheme, Nabo Africa Funds, Old Mutual Unit Trust Scheme, Equity Investment Bank Collective

Investment Scheme, Dry Associates Unit Trust Scheme, Co-op Trust Fund, Apollo Unit Trust Scheme, Cytonn Unit Trust Scheme, Alphafrica Umbrella Fund, Wanafunzi Investment Unit Trust Fund, Absa Unit Trust Funds, and Masaru Unit Trust Scheme, ADAM Unit Trust Scheme, Natbank Unit Trust Scheme, GenAfrica Unit Trust Scheme.

The CIC Unit Trust Scheme maintained the lead in managing the highest Assets Under Management of KShs.56.28 billion, which represents 41.79% of the total AUM, followed by NCBA Unit Trust Scheme which managed KShs.18.00 billion”. In turn, the Coop Unit Trust Scheme registered the highest percentage increment of 28.11% between Q4.2021 and Q3.2021 recording KShs. 2,801,034,045.80 as on 31st December 2021 from KShs. 2,186,500,884.97 recorded in the last quarter.

Appendix B

History and development of the Nairobi Securities Exchange (NSE)

The history of the Nairobi Securities Exchange (NSE) can be divided into two stages: the developmental stage and the revitalisation stage. According to Ngugi (2003), the developmental stage consists of four periods, namely the initiation period (1920's to 1953), the formalisation stage (1954 to 1963), the post-independence stage (1964 to 1970) and the Capital Issue Committee and Taxation policy stage (1971 to 1989).

The developmental stage

The inception stage

The first period in the developmental stage is the inception period, which was from 1920 to 1953. This was the period when the NSE commenced (Parkinson, 1984; Munga, 1974) note that the Bourse started in 1920. The period was characterised by no rules or regulations governing the Bourse. Trading was conducted based on gentleman's agreements, and there was no physical trading floor or specialised brokers. The establishment of the first brokerage firm by Francis Drummond took place during this period in 1951.

The formalisation stage

This stage was the period during which the Bourse became a formal entity recognised by the government of Kenya as a Kenyan exchange. The exchange was formalised in the period of 1954 to 1963. Ngugi (2003) explains that the Bourse was registered under the Societies Act in 1954 as an association of stockbrokers. Clearance before the registration had to be obtained from the London Stock Exchange (LSE) which recognised the NSE as an overseas stock exchange. This implies that the NSE was directly under the LSE at this point. The clearance by the LSE and the legal registration gave the NSE credibility in the marketplace.

The NSE self-regulated during this period. The self-regulatory framework was borrowed from the LSE and a committee of five effected the regulations and rules of the NSE. According to the writer, the committee was given power to govern and manage the exchange. At this point, there was no physical trading floor and no specialists. Clearly, the Bourse was not fully established at this time. Ngugi (2003) explains that a periodic call auction trading system was in place, and transactions were exchanged in

coffee house forums. Prices were determined mainly through negotiations. Buying and selling of shares was conducted at any time during the business day at prices established at the daily meetings, and the Bourse had a listing of 46 companies.

The post-independence stage

The post-independence period was characterised by shifting of foreign owned companies into Kenyan-owned businesses and the creation of new businesses by the citizens of Kenya. As a result, within a short period of time, the market was filled with Kenyan-owned companies. Ngugi (2003) explains that at this stage, there was also a limitation on free movement of trade due to exchange control regulations. As a result, the scope of the NSE as a regional market in East Africa was limited, which explains the delisting of companies listed in the NSE originating from Uganda and Tanzania.

The Capital Issue Committee and taxation policy stage

Next was the Capital Issue Committee and Taxation policy stage. Ngugi, (2003) notes that 1971 to 1988 is when the Capital Issue Committee (CIC) was founded. The government sought to have tighter controls of the stock market hence the formation of CIC in 1971. This committee was established under the Ministry of Finance, and it had representatives from the Central Bank, the Ministry of Commerce and Industry, and the Treasury. The aim of the committee was to regulate the stock market. It was, however, noted that there were no clear criteria on which decisions were made. There were pitfalls in the regulatory framework. Ngugi (2003) discusses these as including a lack of comprehensive information that made raising capital difficult for companies. Also, a tight taxation policy to control movement of funds outside the country was set up. For instance, there was double taxation of share returns, and it became more expensive for companies to provide after tax return on equity. Expenses of raising share capital of debentures issues were not allowed to be deducted from taxable income. These were disincentives of raising equity from public offers. This period also saw the rise of Government stocks listed in the NSE, and by 1988, all government stocks were listed on the NSE.

Revitalisation stage

The NSE was not performing well after the post-independence stage. This led to a period where the government saw it fit to revive the sector. A series of actions that sought to revive the Bourse ensured. Ngugi (2003) notes that despite the Government realising that the capital market was not contributing to

the economy in the development process in the early 1970's (it was characterised by weak development of financial institutions and a thin and inactive stock market), reforms were only implemented in the 1990s. This was after the IFC/CBK (1984) study took place, whose recommendations became a blueprint in the reform process. The recommended developments included removal of taxation differences between debt and equity financed, the establishment of a proper regulatory authority, and developing money and capital markets. The reform process was implemented together with the overall financial sector reforms. These enhanced developments in the finance sector as a whole. These reforms aimed at reducing transactional costs, facilitate competitiveness and increase liquidity, and enhance the price discovery process (Ngugi, 2003).

Among the reforms that were undertaken are encouraging foreign investments and relaxing the tax policy. Ngugi (2003) points out that the Kenyan Government relaxed restrictions on foreign ownership in locally controlled companies subject to an aggregate limit of 20%, with no single not exceeding 2.5%. To help encourage foreign portfolio investments, these were doubled to 40% and 5% respectively in the June 1995 budget. The entire Exchange Control Act was repealed in December 1995 (The NSE Market Fact File, 2008). A discriminative tax policy that penalised share investors heavily (a policy that was adopted in the post-independence period) was removed in favour of an incentive-based tax policy regime. This regime was adopted in the reform period to enhance the competitiveness of the financial assets and to reduce the barriers to listing new issues.

Laws and regulations in any capital market are very important, and at this point the exchange had to be regulated. Ngugi (2003) notes that the Capital Markets Authority (CMA) was established in 1990 through the Capital Markets Authority Act (CAP 485A). The purpose of this body is to promote and facilitate the development of an orderly and efficient capital market in Kenya. The body protects the interests of investors and creates incentives for long-term investment in productive enterprise. The development of a regulatory framework commenced at this point. The CMA made amendments to the CMA Act in 1995, and new rules and regulations were made in 1997, 1998 and 1999 (Ngugi, 2003).

Changes to the Bourse itself took place to improve efficiency and make the Bourse more transparent in its operations. According to Ngugi (2003), in 1991, share trading moved from coffee-house to a floor based open outcry system. This open system gave all buyers and sellers an equal chance at trading. In

addition, trading took place from Monday to Friday 10.00am to 12.00 noon. Trading was not done during public holidays. Transactions at this point were effected in a week or two, thus affecting the liquidity of the market because the period was too long. The need for a Central Depository System (CDS) was therefore felt. Changes began to take effect to facilitate a central depository system. Ngugi (2003) notes that the transaction period was moved to T+5 and providing shareholder with their shares within seven days. The aim of the CDS was to shorten the registration process, boost liquidity in the market, increase market activity, reduce market risk, attain international standards, and deliver the NSE mission statement. In 1999, the Central Depository and Settlement Corporation Ltd was set up. These bear evidence of the efforts by the Kenyan government to develop the Kenyan Bourse as recommended by the international bodies at this time.

Development of NSE since 2000

In 2001, the NSE was divided into three market segments, namely the Main Investment Market Segment (MIMS); the Alternative Investment Market Segment (AIMS); and the Fixed Income Market Segment (FIMS) (Capital Markets Authority, 2002; NSE 2020). The MIMS is the main quotation market. Companies listed under this segment are in the agricultural sector; the industrial and allied sector; the finance and investment sector; and the commercial and services sector (Capital Markets Authority, 2002). The AIMS provides an alternative method of raising capital to small, medium-sized and young companies that find it difficult to meet the more stringent listing requirements of the MIMS. This proves that the NSE has put into consideration the needs of all kinds of companies at different stages of growth. The FIMS, on the other hand, provides an independent market for fixed income securities, such as treasury bonds, corporate bonds, preference shares and debenture stocks, as well as short-term financial instruments, such as treasury bills and commercial papers (CMA, 2002; NSE, 2012).

Exchanges require a central depository system (CDS) to be in place for it to operate. The NSE (2022) indicated that the Central Depository Act 2000 was commenced and operationalised, followed by the automation of the NSE in 2004 and the commissioning of the Central Depository System in the same year. Live trading commenced in 2006 through the automated trading system (ATS). The Bourse at this time increased its trading hours from two to three hours, and in 2008, the NSE extended trading hours from 9am to 3pm, Monday to Friday. The NSE implemented the Wide Area Network in 2008 to enable

remote trading. The settlement cycle was moved from T+5 to T+3 in line with international standards in 2010 (NSE, 2022; NSE fact file 2008). This meant a shorter transaction period.

The NSE has entered into various Memoranda of understanding (MoU's) with different exchanges in its efforts towards integration. In 2004, memoranda of understanding (MoU's) between NSE and Dar es Salaam stock exchange and the Ugandan securities exchange came into effect, and the East Africa securities exchange association was formed (NSE, 2022; NSE fact file, 2008). In 2012, the exchange entered into yet another MoU with Somalia Stock Exchange investment cooperation (SSE) in order to establish business between the two exchanges. It is presumed that this was in an effort to improve efficiency through integration. The Bourse has also entered into an MoU with the Shanghai Stock Exchange (SSE) and the Korean Exchange (KRX) for collaboration (NSE, 2022; NSE fact file 2008).

Further developments were undertaken between the period of 2008 to 2014. According to the Bourse, NSE (2022), the NSE launched the smart youth investment challenge in 2008 to encourage youth investment. In 2009, the complaints handling units (CHU) was formed in a bid to protect investors and listed companies. Automation of bonds was launched in 2009. In addition, the NSE changed its name from the Nairobi Stock Exchange to the Nairobi Securities Exchange in 2011. In 2012, the Bourse became a member of the financial information services division (FISD) and the software and information industry association (SIIA). The Bourse was likewise admitted to the Board of Association of Futures market (AFM), and Centum Investment Company listed an equity linked note for the first time in East Africa.

As a result of all these changes, the NSE was recognised by the Africa investor index. According to the NSE (2022), the 2013 Africa Investor Index Series Awards ranked the NSE as the winner of the most innovative African Stock Exchange category. The Bourse won because of its initiatives to increase company listings and diversify asset classes.

Further developments came in 2014. There have been further developments of the NSE (NSE, 2022; NSE fact file, 2008); after the Bourse celebrated its 60th anniversary, the Exchange was demutualised and became self-listed, and soon afterwards the Bourse was made constituent of the prestigious FTSE Mondo Visione Exchanges index. The NSE has been admitted to the World Federation of Exchange and

a new trading system provided by Millenium Technologies provided by the LSE group was put in place. The CMA recognised the NSE as a self-regulatory organisation.

New products have been introduced at the Bourse between the period of 2015 and 2019. It is noted (NSE, 2022; NSE fact file 2008) that the exchange became the 4th in Africa to introduce Real Estate Investment Trust (REITS). The Stanlib Fahari REIT was listed as the first REIT in the exchange. The Barclays New Gold ETF was listed in the NSE during this period, and the Bourse was the first exchange in East Africa to introduce ETFs. A new programme named 'Ibuka' was launched by the Bourse that provides an opportunity for companies to develop their business models. The Green Bonds listing rules were revised in order to list the bond and offer new class of asset at the exchange. The NSE launched NEXT Derivatives Market in 2019, and the NSE was the second exchange in Africa to offer the derivatives market after South Africa. The launch enables the NSE to trade in single stocks and index futures.

Despite these developments in the market and the increase of investment instruments that have been introduced to the NSE, index funds have not yet been introduced in the NSE. This study seeks to find out whether the market is suitable for the introduction of index funds, and this motivates the conceptual framework presented in Section 4.3. The conceptual framework aims at explaining the relationship between the variables in relation to the foundational theory. The framework also guides the research in terms of models to be employed and the methodology itself.

NSE investment products

All kinds of investors, including mutual funds, institutional investors, and retail investors, are invited to invest in instruments offered at the NSE. Mutual funds invest in the investment products offered at the Bourse. Unfortunately, index funds have not been introduced in the Kenyan financial markets. According to the NSE (2022), the investment vehicles offered to the public include equities; the NSE offers equities for trading in the main investment market segment, Alternative investment segment, growth enterprise market segment and real exchange traded funds (ETF) are offered at the market. In addition, debt instruments are also offered at the NSE. These instruments include corporate bonds, green bonds, and Government bonds. The unquoted securities platform is available on the platform. Derivatives are also offered in the market. The Section that follows provides a brief discussion of these instruments.

Bonds are fixed income securities that are offered by the Government, corporations and other institutional entities to raise capital for investment purposes, and for projects. Riley and Brown (2009) define bonds as long-term fixed obligation debt securities that are offered to the public in affordable, denominations. They differ from other debt such as individual mortgages and privately placed debt obligations, because they are sold to the public rather than channelled directly to a single lender. This increases their availability to investors. Reilly and Brown (2009) further describe bonds as fixed instruments, because they are paid out to the issuer at a fixed date at maturity and interest is paid out periodically to the holder of the debt security. Thus, bonds offer alternative investments to the investor. The NSE (2022) states that apart from corporate bonds, green bonds and Government bonds, the NSE has offered M-Akiba Infrastructure bonds in the recent past, these bonds are traded on the exchange as the secondary market and investors are free to invest in the investment vehicles (NSE, 2022).

Corporate bonds are offered at the NSE, as stated above. The NSE (2022) defines a corporate bond as a fixed income instrument issued by a company in order to raise capital. These bonds are offered at the NSE for the Kenyan companies to access capital that is long-term in nature at competitive rates. The main aim of this is to enable growth of the economy through the private sector. The NSE makes it possible for issuers of bonds to raise capital very quickly and from different kinds of investors. The NSE also gives investors the advantage of accessing a wide array of bonds that are less risky assets and less volatile. Liquidity is also offered to the investor, making it easy for him or her to invest in the instrument. The NSE (2022) lists the Corporate bonds that are currently being offered or being issued at the NSE as the East African Breweries Limited Bond, the Family Bank Limited Bond and the Centum Investment Bond. These bonds offer coupons of between 12% and 13.75% per annum.

Furthermore, the green bond is also offered by the NSE. In this regard, the Bourse has been noted to be an innovator in green finance within Africa. The NSE (2022) posits that this green bond is issued by the Acorn Holdings Limited at a coupon of 12.25% with a five-year period from October 2019 to October 2024. The NSE (2022) defines a green Bond as, “fixed income instruments whose proceeds are earmarked exclusively for projects with environmental benefit mostly related to climate change mitigation or adaptation but also to natural resource depletion, loss of biodiversity and air water or soil pollution”.

Apart from the obvious benefits of green bonds giving investors a chance to affect the climate positively, the bond also provides an opportunity for investors to mitigate climate change risk on their own

investments. This is of course assuming that it is also a form of diversification that is offered within the NSE, enabling investors to diversify risks. Green bonds offer a perfect opportunity for investment towards retirement, like any other bond would (NSE, 2022). The issuer has a chance to access a broad base of investors within the NSE while raising capital at a lower cost. Perceptions of the issuer are improving, and the issuer is viewed as an increasingly credible company because of its care for the climate. Bond investors are normally long-term investors, and this enables the company issuing the green Bond to be assured of the longevity of the investment for it to carry out its investment activities over the long term (NSE, 2022).

In the next instance, treasury bonds that are listed in the NSE for secondary trading. The NSE (2022) defines treasury bonds as bonds that are government-backed bonds and are medium to long-term forms of investments. The CBK (2020) defines treasury bonds as medium to long term investments that typically offer interest payment every six months through to bond maturity. Primarily, the securities are traded in the Central Bank of Kenya's monthly auctions where the interest rates are decided upon and locked in for the entire lifetime of the bond until maturity time (NSE, 2022; CBK, 2022). It follows that as much as the security is long-term, investors have the advantage of interest payments every six months, thus assuring the investor of regular returns. Treasury bonds are secure, because they are backed by the Government and can be relied upon. The Central Bank states that, "investing in treasury bonds is investing in the Government of Kenya" (CBK, 2022). The bank adds that these bonds are auctioned on a monthly basis by the bank itself in the primary markets, where the bank offers a variety of treasury bonds throughout the year. The Central Bank also indicates that this bond can attract tax exemption hence offering higher returns to the Investor. Investors are also assured of flexibility in that they offer different types of treasury bonds that are auctioned every month. Consequently, investors have a variety of investments opportunities in treasury bonds. These bonds are low-risk, and therefore they are a suitable safe investment vehicle for all types of investors.

The NSE has won awards for being one of the most innovative Bourses in Africa. M-kiba was one of the most innovative products of the Bourse. M-Akiba is the first of its kind in the world. The product enables an investor to invest in a government Bond with as low as Ksh. 3,000 (Usd. 30) using the mobile money platform. The NS, (2022) explains that this investment product was launched by the government of Kenya in 2017 in its bid to raise infrastructure capital. It is one of the most unique and innovative products to be listed in the NSE that was intended to attract local investors and encourage saving amongst

Kenyans. This is because of the low amount of money required for investment. The NSE (2020) states that the bond targeted middle to low-income earners and the Government sought to make this form of investment simple and easily accessible to many Kenyans. Because of this, the bond became well-known and popular among Kenyans. In addition, according to the National Treasury and Planning (2020), M-Akiba bond has been described as a “retail infrastructure bond” issued by the Government of Kenya under the National Treasury. It is administered through the Central Bank of Kenya in collaboration with NSE, the Central Depository Settlement Corporation and mobile network operators and the Kenya Association of stockbrokers and Investment bank. The NSE (2020) notes that M-Akiba is a secure low entry-level bond that had a tax-free interest income and an investor can exit easily. This bond has since matured, but the government of Kenya plans to re-launch it.

REITs are investment vehicles that are listed in the NSE, as discussed earlier. The NSE (2020) defines a REIT as a regulated CIS that assists investors to pool funds for the acquisition of units in a Trust for the purpose of earning interest from real estate. This implies that REITs enable investors to access investment in the real estate with minimal amounts of cash. Investors can invest in I-REITs or D-REITs. The CMA (2020) describes an I-REIT as a security that, “primarily derives its revenue from property rentals. It owns and manages income generating real estate for the benefit of its investors”. On the other hand, a D-REIT is a real estate investment that is involved in development of properties (CMA, 2020). These NSE listed products offer long-term returns; in the case of I-REIT, consistent income returns, liquidity, and tax benefits.

An ETF, as defined earlier, is a listed invested product that tracks the performance of either an equity index, a bond index, a sector, or a specific commodity. The NSE has listed the Absa Gold backed ETF issued by Absa Group in 2016 (NSE, 2020).

Equities are investment vehicles offered at the NSE. Currently, there are 66 companies listed at the Exchange. According to CMA (2019), an equity is a stock that represents an ownership of a limited liability company. Equity ownership can be obtained through an Initial Public Offer (IPO), a Rights Issue or through secondary stock purchase at the Nairobi Securities Exchange (NSE). Consequently, an investor can choose to trade and invest in equity listed in the different segments at the NSE. The NSE (2020) explains that companies are listed at the Main Market Investment segment. This is where large and established businesses are listed. Companies are likewise listed in the Alternative Investment Market

Segment which accommodates mid cap companies in Kenya. Lastly, the Growth Enterprise Market Segment (GEMS) is where small and medium capped companies are listed. Thus, investors can invest in equities through brokers on the online and mobile platforms. Another platform where securities are traded is at the Unquoted Securities Platform. According to the NSE (2022), “The Unquoted Securities Platform (USP) is an automated solution for the issuance and trading of securities of unquoted companies” (NSE, 2022).

Derivatives are also offered in the market. Although the derivative market is new, it is gaining popularity. CMA (2022) states that as at the end of the first quarter of 2022, the turnover for derivatives was Kes. 43, 602,850. Derivatives are contracts that are derived from underlying assets. The CMA (2022) describes a derivative as “a financial instrument whose value is derived from the value of one or more underlying assets. Derivatives generally assume the form of (legal) contracts in which two parties agree to payoffs based upon the value of an underlying asset or other data at a particular point in time”. The CMA categorises derivatives into four categories: forwards, futures, options and swaps. Derivatives are traded on the NEXT market, which is an approved institution of the CMA (CMA, 2022). NEXT is the Nairobi Securities Exchange (NSE) derivatives market where the futures contracts; that is, the equity index futures and the single stock futures are traded. The equity index futures contract enables parties to buy or sell underlying listed financial instruments at a fixed price at a particular date in the future. The contracts are based on the NSE 25 index. A single stock futures, on the other hand, are futures contracts where investors agree to buy or sell stocks of a company at an agreed upon price in the future (NSE, 2022).

The NSE has developed over the years, offering depth and attracting more participants at the NSE. The NSE offers listed and unlisted equities, bonds, treasury bills, an ETF, REITs and derivatives. Further improvements can be made at the NSE by offering more products to investors. Index funds are one such a product type. The absence of index funds as an investment product means that the Kenyan investor does not have the opportunity to take advantage of the low cost and diversified nature of the product or the possibility of earning higher returns.

Conclusion

The Nairobi Securities Exchange commenced in 1920, at that time it was known as the Nairobi Stock Exchange. Thereafter came the formalisation stage in which the Bourse was recognised by the London

Stock Exchange (LSE). The Bourse also operated under LSE. After independence, the NSE did not perform at its best, and soon after came the revitalisation stage that occurred during the 1990's. During this stage, foreign investment was encouraged, a review was made on taxation policy and favourable taxes were formulated. The regulatory body (the Capital Markets Authority (CMA)) was formed at this time.

Since the revitalisation stage, there have been major developments in the 2000's. The market was divided into three segments: the Main Investment Market (MIMS), the Alternate Investment Market (AIMS) and the Fixed Income Market Segment (FIMS). There have been major developments in the recent past: the Central Depository System (CDS) has been commissioned, the Bourse has entered several memoranda of understanding with other exchanges so as to develop the Bourse and four more stock indices have been constructed.

Appendix C

Registration of Title



NWU Higher Degree Administration

Private Bag X1290, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222

Fax: 018 299-4910

Web: <http://www.nwu.ac.za>

Higher Degree Administration

Tel: 018 299 2626

Email: 21711542@nwu.ac.za

Dear Ms Nyauncho

REGISTRATION OF TITLE

At the recent meeting of a relevant committee meeting of the Faculty of Economic and Management Sciences your title was approved as follows:

Investigating the suitability of introducing Index Funds in Kenya

The above-mentioned title may under **no circumstances** be changed without consulting your supervisor and obtaining the approval from the relevant committee in the mentioned faculty, in regard of which this office must be furnished with the latest approved title.

In the instance that you wish to submit for examination, please inform your supervisor/promoter accordingly. *Also ensure absolute adherence to the prescripts of A Rule 4.10 for the submission of a Master's study and of A rule 5.10 for the submission of Doctoral thesis.*

Upon approval of your supervisor/promoter, please ensure that the Notice of Submission form is submitted as soon as possible if you intend to submit during the November/ December 2021 submission period.

Note that the Notice of Submission-form is available at the Higher Degree Administration Officer or the Faculty Administrator of the faculty.

For ease of reference, herewith a reference to the following useful resources:

- [General Academic Rules \(A-Rules\):](#)
- [Manual for Master's and Doctoral Studies:](#)
- [Policy on academic integrity:](#)

We wish you a pleasant and successful period of study.

Yours sincerely

Mrs N Blom
for REGISTRAR

Original details: (10812187) M:SHDA Toolbox/Phase 2/1 Title Registration/Title registration letter.docm
13 February 2019

File reference: 7.1.11.1.2

Appendix D

Ethical Clearance



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Web: <http://www.nwu.ac.za>

Economic and Management Sciences Research
Ethics Committee (EMS-REC)

30 August 2021

Prof Musvoto and Dr Sonono
Per e-mail
Dear Prof Musvoto and Dr Sonono,

EMS-REC FEEDBACK: 27082021
Student: Nyauch, V (28209818)(NWU-00952-21-A4)
Study leader: Prof W Musvoto and Dr Sonono – PhD in Business Administration

Your ethics application on, *Investigating the suitability of introducing index funds in Kenya*, which served on the EMSREC meeting of 27 August 2021, refers.

Outcome:

Approved as a minimal risk study. A number **NWU-00952-21-A4** is given for one year of ethics clearance. Recommendations was made by the reviewers.

Please note that the ethics approval of this application is subject to the Covid-19 protocols.

Kind regards,

**Mark
Rathbone**

Digitally signed by Mark
Rathbone
DN: cn=Mark Rathbone, o=North-
West University, ou=Business
Management,
email=mark.rathbone@nwu.ac.za,
c=ZA
Date: 2021.08.31 10:10:41 +0200

Prof Mark Rathbone
Chairperson: Economic and Management Sciences Research Ethics Committee (EMS-REC)

Appendix E

Code of Conduct

CODE OF CONDUCT FOR RESEARCHERS

This code of conduct is applicable to all NWU researchers.

As a researcher of the North-West University (NWU), I subscribe to the rules of the NWU Institutional Research Ethics Regulatory Committee (IRERC), all applicable policies of the NWU as well as all national and international laws and regulations applicable to my field of study. Furthermore, I commit myself to abide by the ethical principles and responsibilities as set out in the Singapore statement on Research Integrity (22 September 2010), in any and all research endeavours that I undertake as a researcher of the NWU.

The four major principles of research integrity to which I will adhere and that will guide my research are:

- Honesty in all aspects of research
- Accountability in the conduct of research
- Professional courtesy and fairness in working with others
- Good stewardship of research on behalf of others

Consequently I will also adhere to the following ethical responsibilities:

1. I will take responsibility for the originality and trustworthiness of my research.
2. I will stay abreast of and adhere to all institutional, national, and international laws, regulations, and policies applicable and related to my research.
3. I will at all times employ appropriate research methods, base my conclusions on critical analysis of the evidence and report my findings and interpretations fully and objectively.
4. I will keep clear and accurate records of all research that I have conducted in a manner that will allow verification and replication of my work by others, if applicable.
5. I will, where applicable, share my data and findings openly and promptly, in line with external funding rules. This will be done as soon as possible after I have had an opportunity to establish priority and ownership claims.
6. I will take responsibility for my own contributions to publications, funding applications, reports and other representations of my research. I will also and only include authors who meet valid authorship criteria.
7. I will acknowledge the names and roles of those who made significant contributions to my research in publications, including writers, funders, sponsors, and others, but do not meet authorship criteria.
8. In my peer reviews, I will provide fair, prompt and rigorous evaluations and I will respect confidentiality when I review others' work.
9. I will disclose all conflicts of interest (financial and other) that could compromise the trustworthiness of my work in research proposals, publications, public communications, and in review activities.
10. When I publically address a community in the spirit of academic freedom, I will in all stages base my professional comments on research findings (if applicable) and my expertise. I will distinguish between professional comments and opinions based on personal views.
11. Should any irresponsible research practices and/or research misconduct become known to me or brought under my attention, I will report such irresponsible research activities to the appropriate authorities.
12. I will respond to irresponsible research practices or conduct, by taking prompt actions as set out in the procedures of the university. I will also protect those who report misconduct in good faith, to the best of my abilities.
13. I will endeavour to create and sustain an environment that encourage research integrity through education of students, research teams and peers, as well as abide by policies, and reasonable standards for advancement.
14. I will at all times weigh societal benefits against the risks inherent in my work.

Name: Vera K. Nyauncho

Signature:



Date: 01/07/21

Appendix F

Language editor declaration

Declaration

This is to declare that I, Dr. L Combrink

Language editor and translator

have language edited the study

with the title

**INVESTIGATING THE SUITABILITY OF
INTRODUCING INDEX FUNDS IN KENYA**

by

NYAUNCHO V. K.



Date: December 2022